Abstract: At a multifunction device with a display and a touch-sensitive surface, a plurality of objects are displayed on the display. The plurality of objects has a first layer order. A first contact is detected at a location on the touch-sensitive surface that corresponds to a location of a respective object of the plurality of objects. While detecting the first contact, a gesture that includes a second contact is detected on the touch-sensitive surface. In response to detecting the gesture, the plurality of objects is reordered in accordance with the gesture to create a second layer order that is different from the first layer order. In some embodiments, the position of the respective object within the first order is different from the position of the respective object within the second order.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
Device, Method, and Graphical User Interface for Reordering the Front-to-Back Positions of Objects

TECHNICAL FIELD

[0001] This relates generally to electronic devices with touch-sensitive surfaces, including but not limited to electronic devices with touch-sensitive surfaces that are used to reorder the front-to-back positions of objects on a display.

BACKGROUND

[0002] The use of touch-sensitive surfaces as input devices for computers and other electronic computing devices has increased significantly in recent years. Exemplary touch-sensitive surfaces include touch pads and touch screen displays. Such surfaces are widely used to manipulate user interface objects on a display.

[0003] Exemplary manipulations include adjusting the layer order of one or more user interface objects (i.e., the z-order or front-to-back order of the user interface objects). Exemplary user interface objects include digital images, video, text, icons, and other graphics. A user may need to perform such manipulations on user interface objects in an operating system graphical user interface (e.g., the user interface for Mac OS X from Apple Inc. of Cupertino, California or the user interface for iOS from Apple Inc. of Cupertino, California), a file management program (e.g., Finder from Apple Inc. of Cupertino, California), an image management application (e.g., Aperture or iPhoto from Apple Inc. of Cupertino, California), a digital content (e.g., videos and music) management application (e.g., iTunes from Apple Inc. of Cupertino, California), a drawing application, a presentation application (e.g., Keynote from Apple Inc. of Cupertino, California), a word processing application (e.g., Pages from Apple Inc. of Cupertino, California), a website creation application (e.g., iWeb from Apple Inc. of Cupertino, California), a disk authoring application (e.g., iDVD from Apple Inc. of Cupertino, California), or a spreadsheet application (e.g., Numbers from Apple Inc. of Cupertino, California).

[0004] But existing methods for reordering the front-to-back positions of user interface objects are cumbersome and inefficient. For example, using a sequence of mouse-based inputs to select one or more user interface objects and reorder the selected user interface objects is tedious and creates a significant cognitive burden on a user. In addition,
existing methods take longer than necessary, thereby wasting energy. This latter consideration is particularly important in battery-operated devices.

SUMMARY

[0005] Accordingly, there is a need for computing devices with faster, more efficient methods and interfaces for reordering the front-to-back positions of user interface objects. Such methods and interfaces may complement or replace conventional methods for reordering objects. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated computing devices, such methods and interfaces conserve power and increase the time between battery charges.

[0006] The above deficiencies and other problems associated with user interfaces for computing devices with touch-sensitive surfaces are reduced or eliminated by the disclosed devices. In some embodiments, the device is a desktop computer. In some embodiments, the device is portable (e.g., a notebook computer, tablet computer, or handheld device). In some embodiments, the device has a touchpad. In some embodiments, the device has a touch-sensitive display (also known as a "touch screen" or "touch screen display"). In some embodiments, the device has a graphical user interface (GUI), one or more processors, memory and one or more modules, programs or sets of instructions stored in the memory for performing multiple functions. In some embodiments, the user interacts with the GUI primarily through finger contacts and gestures on the touch-sensitive surface. In some embodiments, the functions may include image editing, drawing, presenting, word processing, website creating, disk authoring, spreadsheet making, game playing, telephoning, video conferencing, e-mailing, instant messaging, workout support, digital photographing, digital videoing, web browsing, digital music playing, and/or digital video playing. Executable instructions for performing these functions may be included in a computer readable storage medium or other computer program product configured for execution by one or more processors.

[0007] In accordance with some embodiments, a multifunction device includes a display, a touch-sensitive surface, one or more processors, memory, and one or more programs. The one or more programs are stored in the memory and configured to be executed by the one or more processors. The one or more programs include instructions for: displaying a plurality of objects on the display. The plurality of objects has a first layer order. A "layer order" is also called a "z order" or "front-to-back order" of the objects. The
one or more programs further include instructions for detecting a first contact at a location on
the touch-sensitive surface that corresponds to a location of a respective object on the display;
and, while detecting the first contact, detecting a gesture that includes a second contact on the
touch-sensitive surface. The one or more programs also include instructions for, in response
to detecting the gesture, reordering the plurality of objects in accordance with the gesture to
create a second layer order that is different from the first layer order.

[0008] In accordance with some embodiments, a method is performed at a
multifunction device with a display and a touch-sensitive surface. The method includes:
displaying a plurality of objects on the display. The plurality of objects has a first layer
order. The method further includes detecting a first contact at a location on the touch-
sensitive surface that corresponds to a location of a respective object on the display; and,
while detecting the first contact, detecting a gesture that includes a second contact on the
touch-sensitive surface. The method also includes, in response to detecting the gesture,
reordering the plurality of objects in accordance with the gesture to create a second layer
order that is different from the first layer order.

[0009] In accordance with some embodiments, a computer readable storage medium
has stored therein instructions which when executed by a multifunction device with a display
and a touch-sensitive surface, cause the device to: display a plurality of objects on the
display. The plurality of objects has a first layer order. The instructions further cause the
device to detect a first contact at a location on the touch-sensitive surface that corresponds to
a location of a respective object on the display; and, while detecting the first contact, detect a
gesture that includes a second contact on the touch-sensitive surface. The instructions also
cause the device to, in response to detecting the gesture, reorder the plurality of objects in
accordance with the gesture to create a second layer order that is different from the first layer
order.

[0010] In accordance with some embodiments, a graphical user interface on a
multifunction device with a display, a touch-sensitive surface, a memory, and one or more
processors to execute one or more programs stored in the memory includes a plurality of
objects. The plurality of objects has a first layer order. A first contact is detected at a
location on the touch-sensitive surface that corresponds to a location of a respective object on
the display. While detecting the first contact, a gesture that includes a second contact is
detected on the touch-sensitive surface. In response to detecting the gesture, the plurality of
objects is reordered in accordance with the gesture to create a second layer order that is
different from the first layer order.

[0011] In accordance with some embodiments, a multifunction device includes: a
display; a touch-sensitive surface; means for displaying a plurality of objects on the display.
The plurality of objects has a first layer order. The multifunction device further includes
means for detecting a first contact at a location on the touch-sensitive surface that
 corresponds to a location of a respective object on the display; and, means for, while
detecting the first contact, detecting a gesture that includes a second contact on the touch-
sensitive surface. The multifunction device also includes means, responsive to detecting the
gesture, for reordering the plurality of objects in accordance with the gesture to create a
second layer order that is different from the first layer order.

[0012] In accordance with some embodiments, an information processing apparatus
for use in a multifunction device with a display and a touch-sensitive surface includes: means
for displaying a plurality of objects on the display. The plurality of objects has a first layer
order. The information processing apparatus further includes means for detecting a first
contact at a location on the touch-sensitive surface that corresponds to a location of a
respective object on the display; and, means for, while detecting the first contact, detecting a
gesture that includes a second contact on the touch-sensitive surface. The information
processing apparatus also includes means, responsive to detecting the gesture, for reordering
the plurality of objects in accordance with the gesture to create a second layer order that is
different from the first layer order.

[0013] In accordance with some embodiments, an electronic device includes a display
unit configured to display a plurality of objects, where the plurality of objects has a first layer
order; a touch-sensitive surface unit configured to receive contacts and gestures; and a
processing unit coupled to the display unit and the touch-sensitive surface unit. The
processing unit is configured to: detect a first contact at a location on the touch-sensitive
surface unit that corresponds to a location of a respective object on the display unit; while
detecting the first contact, detect a gesture that includes a second contact on the touch-
sensitive surface unit; and, in response to detecting the gesture, reorder the plurality of
objects in accordance with the gesture to create a second layer order that is different from the
first layer order.
Thus, multifunction devices with displays and touch-sensitive surfaces are provided with faster, more efficient methods and interfaces for reordering user interface objects using two or more simultaneous user inputs, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for reordering objects.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the aforementioned embodiments of the invention as well as additional embodiments thereof, reference should be made to the Description of Embodiments below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

Figures 1A and 1B are block diagrams illustrating portable multifunction devices with touch-sensitive displays in accordance with some embodiments.

Figure 1C is a block diagram illustrating exemplary components for event handling in accordance with some embodiments.

Figure 2 illustrates a portable multifunction device having a touch screen in accordance with some embodiments.

Figure 3 is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments.

Figures 4A and 4B illustrate exemplary user interfaces for a menu of applications on a portable multifunction device in accordance with some embodiments.

Figure 4C illustrates an exemplary user interface for a multifunction device with a touch-sensitive surface that is separate from the display in accordance with some embodiments.

Figures 5A-5J illustrate exemplary user interfaces for reordering the front-to-back positions of user interface objects in accordance with some embodiments.

Figures 6A-6D are flow diagrams illustrating a method of reordering the front-to-back positions of user interface objects in accordance with some embodiments.

Figure 7 is a functional block diagram of an electronic device in accordance with some embodiments.
DESCRIPTION OF EMBODIMENTS

[0025] Many electronic devices display user interface objects that have a layer order (i.e., a z-order or front-to-back order of the user interface objects). A user typically interacts with such objects by repositioning them on the display, and overlapping objects are displayed on the display in accordance with their front-to-back order (e.g., an object that is "in front" of another object is displayed where the two objects overlap). In addition to repositioning the objects on the display, a user often wants to change the front-to-back order of the objects on the display. A user may want to change the front-to-back order of individual objects or of multiple objects at a time, and may perform many such object re-ordering operations. Thus, to reduce the cognitive burden on a user and to create a faster, more efficient human-machine interface, it is advantageous to have a user interface that enables the user to quickly and efficiently reorder the front-to-back positions of objects on the display. In some of the embodiments described below, such an improved reordering user interface is achieved by detecting a first contact at a location on a touch-sensitive surface that corresponds to a respective object on the display and, while detecting the first contact, detecting a gesture made with a second contact that corresponds to a request to reorder the respective object in the front-to-back order. Detecting the first contact at the location that corresponds to the object allows the user to directly specify at least one of the objects to be reordered within the front-to-back order. A user is then able to reorder objects using a simple finger gesture, without needing to use more cumbersome methods, such as viewing, navigating, and activating commands in a pop-up or pull-down menu.

[0026] Below, Figures 1A-1C, 2, 3, and 7 provide a description of exemplary devices. Figures 4A-4C, 5A-5J. Figures 6A-6D are flow diagrams illustrating a method of re-ordering objects in a front-to-back order. The user interfaces in Figures 5A-5J are used to illustrate the processes in Figures 6A-6D.

[0027] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, circuits, and networks have not been described in detail so as not to unnecessarily obscure aspects of the embodiments.
[0028] It will also be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first contact could be termed a second contact, and, similarly, a second contact could be termed a first contact, without departing from the scope of the present invention. The first contact and the second contact are both contacts, but they are not the same contact.

[0029] The terminology used in the description of the invention herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used in the description of the invention and the appended claims, the singular forms "a", "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will also be understood that the term "and/or" as used herein refers to and encompasses any and all possible combinations of one or more of the associated listed items. It will be further understood that the terms "includes," "including," "comprises," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0030] As used herein, the term "if" may be construed to mean "when" or "upon" or "in response to determining" or "in response to detecting," depending on the context. Similarly, the phrase "if it is determined" or "if [a stated condition or event] is detected" may be construed to mean "upon determining" or "in response to determining" or "upon detecting [the stated condition or event]" or "in response to detecting [the stated condition or event]," depending on the context.

[0031] As used herein, the term "resolution" of a display refers to the number of pixels (also called "pixel counts" or "pixel resolution") along each axis or in each dimension of the display. For example, a display may have a resolution of 320x480 pixels. Furthermore, as used herein, the term "resolution" of a multifunction device refers to the resolution of a display in the multifunction device. The term "resolution" does not imply any limitations on the size of each pixel or the spacing of pixels. For example, compared to a first display with a 1024x768-pixel resolution, a second display with a 320x480-pixel resolution has a lower resolution. However, it should be noted that the physical size of a display depends not only on the pixel resolution, but also on many other factors, including the pixel size.
size and the spacing of pixels. Therefore, the first display may have the same, smaller, or larger physical size, compared to the second display.

[0032] As used herein, the term “video resolution” of a display refers to the density of pixels along each axis or in each dimension of the display. The video resolution is often measured in a dots-per-inch (DPI) unit, which counts the number of pixels that can be placed in a line within the span of one inch along a respective dimension of the display.

[0033] Embodiments of computing devices, user interfaces for such devices, and associated processes for using such devices are described. In some embodiments, the computing device is a portable communications device, such as a mobile telephone, that also contains other functions, such as PDA and/or music player functions. Exemplary embodiments of portable multifunction devices include, without limitation, the iPhone®, iPod Touch®, and iPad® devices from Apple Inc. of Cupertino, California. Other portable devices, such as laptops or tablet computers with touch-sensitive surfaces (e.g., touch screen displays and/or touch pads), may also be used. It should also be understood that, in some embodiments, the device is not a portable communications device, but is a desktop computer with a touch-sensitive surface (e.g., a touch screen display and/or a touch pad).

[0034] In the discussion that follows, a computing device that includes a display and a touch-sensitive surface is described. It should be understood, however, that the computing device may include one or more other physical user-interface devices, such as a physical keyboard, a mouse and/or a joystick.

[0035] The device supports a variety of applications, such as one or more of the following: a drawing application, a presentation application, a word processing application, a website creation application, a disk authoring application, a spreadsheet application, a gaming application, a telephone application, a video conferencing application, an e-mail application, an instant messaging application, a workout support application, a photo management application, a digital camera application, a digital video camera application, a web browsing application, a digital music player application, and/or a digital video player application.

[0036] The various applications that may be executed on the device may use at least one common physical user-interface device, such as the touch-sensitive surface. One or more functions of the touch-sensitive surface as well as corresponding information displayed on the device may be adjusted and/or varied from one application to the next and/or within a respective application. In this way, a common physical architecture (such as the touch-
sensitive surface) of the device may support the variety of applications with user interfaces that are intuitive and transparent to the user.

[0037] The user interfaces may include one or more soft keyboard embodiments. The soft keyboard embodiments may include standard (QWERTY) and/or non-standard configurations of symbols on the displayed icons of the keyboard, such as those described in U.S. Patent Applications 11/459,606, "Keyboards For Portable Electronic Devices," filed July 24, 2006, and 11/459,615, "Touch Screen Keyboards For Portable Electronic Devices," filed July 24, 2006, the contents of which are hereby incorporated by reference in their entireties. The keyboard embodiments may include a reduced number of icons (or soft keys) relative to the number of keys in existing physical keyboards, such as that for a typewriter. This may make it easier for users to select one or more icons in the keyboard, and thus, one or more corresponding symbols. The keyboard embodiments may be adaptive. For example, displayed icons may be modified in accordance with user actions, such as selecting one or more icons and/or one or more corresponding symbols. One or more applications on the device may utilize common and/or different keyboard embodiments. Thus, the keyboard embodiment used may be tailored to at least some of the applications. In some embodiments, one or more keyboard embodiments may be tailored to a respective user. For example, one or more keyboard embodiments may be tailored to a respective user based on a word usage history (lexicography, slang, individual usage) of the respective user. Some of the keyboard embodiments may be adjusted to reduce a probability of a user error when selecting one or more icons, and thus one or more symbols, when using the soft keyboard embodiments.

[0038] Attention is now directed toward embodiments of portable devices with touch-sensitive displays. Figures 1A and 1B are block diagrams illustrating portable multifunction devices 100 with touch-sensitive displays 112 in accordance with some embodiments. Touch-sensitive display 112 is sometimes called a "touch screen" for convenience, and may also be known as or called a touch-sensitive display system. Device 100 may include memory 102 (which may include one or more computer readable storage mediums), memory controller 122, one or more processing units (CPU’s) 120, peripherals interface 118, RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, input/output (I/O) subsystem 106, other input or control devices 116, and external port 124. Device 100 may include one or more optical sensors 164. These components may communicate over one or more communication buses or signal lines 103.
It should be appreciated that device 100 is only one example of a portable multifunction device, and that device 100 may have more or fewer components than shown, may combine two or more components, or may have a different configuration or arrangement of the components. The various components shown in Figures 1A and 1B may be implemented in hardware, software, or a combination of both hardware and software, including one or more signal processing and/or application specific integrated circuits.

Memory 102 may include high-speed random access memory and may also include non-volatile memory, such as one or more magnetic disk storage devices, flash memory devices, or other non-volatile solid-state memory devices. Access to memory 102 by other components of device 100, such as CPU 120 and the peripherals interface 118, may be controlled by memory controller 122.

Peripherals interface 118 can be used to couple input and output peripherals of the device to CPU 120 and memory 102. The one or more processors 120 run or execute various software programs and/or sets of instructions stored in memory 102 to perform various functions for device 100 and to process data.

In some embodiments, peripherals interface 118, CPU 120, and memory controller 122 may be implemented on a single chip, such as chip 104. In some other embodiments, they may be implemented on separate chips.

RF (radio frequency) circuitry 108 receives and sends RF signals, also called electromagnetic signals. RF circuitry 108 converts electrical signals to/from electromagnetic signals and communicates with communications networks and other communications devices via the electromagnetic signals. RF circuitry 108 may include well-known circuitry for performing these functions, including but not limited to an antenna system, an RF transceiver, one or more amplifiers, a tuner, one or more oscillators, a digital signal processor, a CODEC chipset, a subscriber identity module (SIM) card, memory, and so forth. RF circuitry 108 may communicate with networks, such as the Internet, also referred to as the World Wide Web (WWW), an intranet and/or a wireless network, such as a cellular telephone network, a wireless local area network (LAN) and/or a metropolitan area network (MAN), and other devices by wireless communication. The wireless communication may use any of a plurality of communications standards, protocols and technologies, including but not limited to Global System for Mobile Communications (GSM), Enhanced Data GSM Environment (EDGE), high-speed downlink packet access (HSDPA), high-speed uplink packet access (HSUPA),
wideband code division multiple access (W-CDMA), code division multiple access (CDMA),
time division multiple access (TDMA), Bluetooth, Wireless Fidelity (Wi-Fi) (e.g., IEEE
802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), voice over Internet Protocol
(VoIP), Wi-MAX, a protocol for e-mail (e.g., Internet message access protocol (IMAP)
and/or post office protocol (POP)), instant messaging (e.g., extensible messaging and
presence protocol (XMPP), Session Initiation Protocol for Instant Messaging and Presence
Leveraging Extensions (SIMPLE), Instant Messaging and Presence Service (IMPS)), and/or
Short Message Service (SMS), or any other suitable communication protocol, including
communication protocols not yet developed as of the filing date of this document.

[0044] Audio circuitry 110, speaker 111, and microphone 113 provide an audio
interface between a user and device 100. Audio circuitry 110 receives audio data from
peripherals interface 118, converts the audio data to an electrical signal, and transmits the
electrical signal to speaker 111. Speaker 111 converts the electrical signal to human-audible
sound waves. Audio circuitry 110 also receives electrical signals converted by microphone
113 from sound waves. Audio circuitry 110 converts the electrical signal to audio data and
transmits the audio data to peripherals interface 118 for processing. Audio data may be
retrieved from and/or transmitted to memory 102 and/or RF circuitry 108 by peripherals
interface 118. In some embodiments, audio circuitry 110 also includes a headset jack (e.g.,
212, Figure 2). The headset jack provides an interface between audio circuitry 110 and
removable audio input/output peripherals, such as output-only headphones or a headset with
both output (e.g., a headphone for one or both ears) and input (e.g., a microphone).

[0045] I/O subsystem 106 couples input/output peripherals on device 100, such as
touch screen 112 and other input control devices 116, to peripherals interface 118. I/O
subsystem 106 may include display controller 156 and one or more input controllers 160 for
other input or control devices. The one or more input controllers 160 receive/send electrical
signals from/to other input or control devices 116. The other input control devices 116 may
include physical buttons (e.g., push buttons, rocker buttons, etc.), dials, slider switches,
joysticks, click wheels, and so forth. In some alternate embodiments, input controller(s) 160
may be coupled to any (or none) of the following: a keyboard, infrared port, USB port, and a
pointer device such as a mouse. The one or more buttons (e.g., 208, Figure 2) may include an
up/down button for volume control of speaker 111 and/or microphone 113. The one or more
buttons may include a push button (e.g., 206, Figure 2). A quick press of the push button
disengage a lock of touch screen 112 or begin a process that uses gestures on the touch
screen to unlock the device, as described in U.S. Patent Application 11/322,549, "Unlocking a Device by Performing Gestures on an Unlock Image," filed December 23, 2005, which is hereby incorporated by reference in its entirety. A longer press of the push button (e.g., 206) may turn power to device 100 on or off. The user may be able to customize a functionality of one or more of the buttons. Touch screen 112 is used to implement virtual or soft buttons and one or more soft keyboards.

[0046] Touch-sensitive display 112 provides an input interface and an output interface between the device and a user. Display controller 156 receives and/or sends electrical signals from/to touch screen 112. Touch screen 112 displays visual output to the user. The visual output may include graphics, text, icons, video, and any combination thereof (collectively termed "graphics"). In some embodiments, some or all of the visual output may correspond to user-interface objects.

[0047] Touch screen 112 has a touch-sensitive surface, sensor or set of sensors that accepts input from the user based on haptic and/or tactile contact. Touch screen 112 and display controller 156 (along with any associated modules and/or sets of instructions in memory 102) detect contact (and any movement or breaking of the contact) on touch screen 112 and converts the detected contact into interaction with user-interface objects (e.g., one or more soft keys, icons, web pages or images) that are displayed on touch screen 112. In an exemplary embodiment, a point of contact between touch screen 112 and the user corresponds to a finger of the user.

[0048] Touch screen 112 may use LCD (liquid crystal display) technology, LPD (light emitting polymer display) technology, or LED (light emitting diode) technology, although other display technologies may be used in other embodiments. Touch screen 112 and display controller 156 may detect contact and any movement or breaking thereof using any of a plurality of touch sensing technologies now known or later developed, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with touch screen 112. In an exemplary embodiment, projected mutual capacitance sensing technology is used, such as that found in the iPhone®, iPod Touch®, and iPad® from Apple Inc. of Cupertino, California.

[0049] A touch-sensitive display in some embodiments of touch screen 112 may be analogous to the multi-touch sensitive touchpads described in the following U.S. Patents:

Touch screen 112 may have a video resolution in excess of 100 dpi. In some embodiments, the touch screen has a video resolution of approximately 160 dpi. The user may make contact with touch screen 112 using any suitable object or appendage, such as a stylus, a finger, and so forth. In some embodiments, the user interface is designed to work primarily with finger-based contacts and gestures, which can be less precise than stylus-based input due to the larger area of contact of a finger on the touch screen. In some embodiments, the device translates the rough finger-based input into a precise pointer/cursor position or command for performing the actions desired by the user.

In some embodiments, in addition to the touch screen, device 100 may include a touchpad (not shown) for activating or deactivating particular functions. In some embodiments, the touchpad is a touch-sensitive area of the device that, unlike the touch screen, does not display visual output. The touchpad may be a touch-sensitive surface that is separate from touch screen 112 or an extension of the touch-sensitive surface formed by the touch screen.
In some embodiments, device 100 may include a physical or virtual wheel (e.g., a click wheel) as input control device 116. A user may navigate among and interact with one or more graphical objects (e.g., icons) displayed in touch screen 112 by rotating the click wheel or by moving a point of contact with the click wheel (e.g., where the amount of movement of the point of contact is measured by its angular displacement with respect to a center point of the click wheel). The click wheel may also be used to select one or more of the displayed icons. For example, the user may press down on at least a portion of the click wheel or an associated button. User commands and navigation commands provided by the user via the click wheel may be processed by input controller 160 as well as one or more of the modules and/or sets of instructions in memory 102. For a virtual click wheel, the click wheel and click wheel controller may be part of touch screen 112 and display controller 156, respectively. For a virtual click wheel, the click wheel may be either an opaque or semitransparent object that appears and disappears on the touch screen display in response to user interaction with the device. In some embodiments, a virtual click wheel is displayed on the touch screen of a portable multifunction device and operated by user contact with the touch screen.

Device 100 also includes power system 162 for powering the various components. Power system 162 may include a power management system, one or more power sources (e.g., battery, alternating current (AC)), a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator (e.g., a light-emitting diode (LED)) and any other components associated with the generation, management and distribution of power in portable devices.

Device 100 may also include one or more optical sensors 164. Figures 1A and 1B show an optical sensor coupled to optical sensor controller 158 in I/O subsystem 106. Optical sensor 164 may include charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) phototransistors. Optical sensor 164 receives light from the environment, projected through one or more lens, and converts the light to data representing an image. In conjunction with imaging module 143 (also called a camera module), optical sensor 164 may capture still images or video. In some embodiments, an optical sensor is located on the back of device 100, opposite touch screen display 112 on the front of the device, so that the touch screen display may be used as a viewfinder for still and/or video image acquisition. In some embodiments, an optical sensor is located on the front of the device so that the user's image may be obtained for videoconferencing while the user views...
the other video conference participants on the touch screen display. In some embodiments, the position of optical sensor 164 can be changed by the user (e.g., by rotating the lens and the sensor in the device housing) so that a single optical sensor 164 may be used along with the touch screen display for both video conferencing and still and/or video image acquisition.

[0056] Device 100 may also include one or more proximity sensors 166. Figures 1A and 1B show proximity sensor 166 coupled to peripherals interface 118. Alternately, proximity sensor 166 may be coupled to input controller 160 in I/O subsystem 106. Proximity sensor 166 may perform as described in U.S. Patent Application Nos. 11/241,839, "Proximity Detector In Handheld Device"; 11/240,788, "Proximity Detector In Handheld Device"; 11/620,702, "Using Ambient Light Sensor To Augment Proximity Sensor Output"; 11/586,862, "Automated Response To And Sensing Of User Activity In Portable Devices"; and 11/638,251, "Methods And Systems For Automatic Configuration Of Peripherals," which are hereby incorporated by reference in their entirety. In some embodiments, the proximity sensor turns off and disables touch screen 112 when the multifunction device is placed near the user's ear (e.g., when the user is making a phone call).

[0057] Device 100 may also include one or more accelerometers 168. Figures 1A and 1B show accelerometer 168 coupled to peripherals interface 118. Alternately, accelerometer 168 may be coupled to an input controller 160 in I/O subsystem 106. Accelerometer 168 may perform as described in U.S. Patent Publication No. 20050190059, "Acceleration-based Theft Detection System for Portable Electronic Devices," and U.S. Patent Publication No. 20060017692, "Methods And Apparatuses For Operating A Portable Device Based On An Accelerometer," both of which are which are incorporated by reference herein in their entirety. In some embodiments, information is displayed on the touch screen display in a portrait view or a landscape view based on an analysis of data received from the one or more accelerometers. Device 100 optionally includes, in addition to accelerometer(s) 168, a magnetometer (not shown) and a GPS (or GLONASS or other global navigation system) receiver (not shown) for obtaining information concerning the location and orientation (e.g., portrait or landscape) of device 100.

[0058] In some embodiments, the software components stored in memory 102 include operating system 126, communication module (or set of instructions) 128, contact/motion module (or set of instructions) 130, graphics module (or set of instructions) 132, text input module (or set of instructions) 134, Global Positioning System (GPS) module (or set of instructions) 135, and applications (or sets of instructions) 136. Furthermore, in some
embodiments memory 102 stores device/global internal state 157, as shown in Figures 1A, IB and 3. Device/global internal state 157 includes one or more of: active application state, indicating which applications, if any, are currently active; display state, indicating what applications, views or other information occupy various regions of touch screen display 112; sensor state, including information obtained from the device's various sensors and input control devices 116; and location information concerning the device's location and/or attitude.

[0059] Operating system 126 (e.g., Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks) includes various software components and/or drivers for controlling and managing general system tasks (e.g., memory management, storage device control, power management, etc.) and facilitates communication between various hardware and software components.

[0060] Communication module 128 facilitates communication with other devices over one or more external ports 124 and also includes various software components for handling data received by RF circuitry 108 and/or external port 124. External port 124 (e.g., Universal Serial Bus (USB), FIREWIRE, etc.) is adapted for coupling directly to other devices or indirectly over a network (e.g., the Internet, wireless LAN, etc.). In some embodiments, the external port is a multi-pin (e.g., 30-pin) connector that is the same as, or similar to and/or compatible with the 30-pin connector used on iPod (trademark of Apple Inc.) devices.

[0061] Contact/motion module 130 may detect contact with touch screen 112 (in conjunction with display controller 156) and other touch sensitive devices (e.g., a touchpad or physical click wheel). Contact/motion module 130 includes various software components for performing various operations related to detection of contact, such as determining if contact has occurred (e.g., detecting a finger-down event), determining if there is movement of the contact and tracking the movement across the touch-sensitive surface (e.g., detecting one or more finger-dragging events), and determining if the contact has ceased (e.g., detecting a finger-up event or a break in contact). Contact/motion module 130 receives contact data from the touch-sensitive surface. Determining movement of the point of contact, which is represented by a series of contact data, may include determining speed (magnitude), velocity (magnitude and direction), and/or an acceleration (a change in magnitude and/or direction) of the point of contact. These operations may be applied to single contacts (e.g., one finger contacts) or to multiple simultaneous contacts (e.g., "multitouch"multiple finger contacts).
In some embodiments, contact/motion module 130 and display controller 156 detects contact on a touchpad. In some embodiments, contact/motion module 130 and controller 160 detects contact on a click wheel.

[0062] Contact/motion module 130 may detect a gesture input by a user. Different gestures on the touch-sensitive surface have different contact patterns. Thus, a gesture may be detected by detecting a particular contact pattern. For example, detecting a finger tap gesture includes detecting a finger-down event followed by detecting a finger-up (lift off) event at the same position (or substantially the same position) as the finger-down event (e.g., at the position of an icon). As another example, detecting a finger swipe gesture on the touch-sensitive surface includes detecting a finger-down event followed by detecting one or more finger-dragging events, and subsequently followed by detecting a finger-up (lift off) event.

[0063] Graphics module 132 includes various known software components for rendering and displaying graphics on touch screen 112 or other display, including components for changing the intensity of graphics that are displayed. As used herein, the term "graphics" includes any object that can be displayed to a user, including without limitation text, web pages, icons (such as user-interface objects including soft keys), digital images, videos, animations and the like.

[0064] In some embodiments, graphics module 132 stores data representing graphics to be used. Each graphic may be assigned a corresponding code. Graphics module 132 receives, from applications etc., one or more codes specifying graphics to be displayed along with, if necessary, coordinate data and other graphic property data, and then generates screen image data to output to display controller 156.

[0065] Text input module 134, which may be a component of graphics module 132, provides soft keyboards for entering text in various applications (e.g., contacts 137, e-mail 140, IM 141, browser 147, and any other application that needs text input).

[0066] GPS module 135 determines the location of the device and provides this information for use in various applications (e.g., to telephone 138 for use in location-based dialing, to camera 143 as picture/video metadata, and to applications that provide location-based services such as weather widgets, local yellow page widgets, and map/navigation widgets).
Applications 136 may include the following modules (or sets of instructions), or a subset or superset thereof:

- contacts module 137 (sometimes called an address book or contact list);
- telephone module 138;
- video conferencing module 139;
- e-mail client module 140;
- instant messaging (IM) module 141;
- workout support module 142;
- camera module 143 for still and/or video images;
- image management module 144;
- video player module 145;
- music player module 146;
- browser module 147;
- calendar module 148;
- widget modules 149, which may include one or more of: weather widget 149-1, stocks widget 149-2, calculator widget 149-3, alarm clock widget 149-4, dictionary widget 149-5, and other widgets obtained by the user, as well as user-created widgets 149-6;
- widget creator module 150 for making user-created widgets 149-6;
- search module 151;
- video and music player module 152, which merges video player module 145 and music player module 146;
- notes module 153;
- map module 154; and/or
- online video module 155.

Examples of other applications 136 that may be stored in memory 102 include other word processing applications, other image editing applications, drawing applications,
presentation applications, JAVA-enabled applications, encryption, digital rights management, voice recognition, and voice replication.

[0069] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, contacts module 137 may be used to manage an address book or contact list (e.g., stored in application internal state 192 of contacts module 137 in memory 102 or memory 370), including: adding name(s) to the address book; deleting name(s) from the address book; associating telephone number(s), e-mail address(es), physical address(es) or other information with a name; associating an image with a name; categorizing and sorting names; providing telephone numbers or e-mail addresses to initiate and/or facilitate communications by telephone 138, video conference 139, e-mail 140, or IM 141; and so forth.

[0070] In conjunction with RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, telephone module 138 may be used to enter a sequence of characters corresponding to a telephone number, access one or more telephone numbers in address book 137, modify a telephone number that has been entered, dial a respective telephone number, conduct a conversation and disconnect or hang up when the conversation is completed. As noted above, the wireless communication may use any of a plurality of communications standards, protocols and technologies.

[0071] In conjunction with RF circuitry 108, audio circuitry 110, speaker 111, microphone 113, touch screen 112, display controller 156, optical sensor 164, optical sensor controller 158, contact module 130, graphics module 132, text input module 134, contact list 137, and telephone module 138, videoconferencing module 139 includes executable instructions to initiate, conduct, and terminate a video conference between a user and one or more other participants in accordance with user instructions.

[0072] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, e-mail client module 140 includes executable instructions to create, send, receive, and manage e-mail in response to user instructions. In conjunction with image management module 144, e-mail client module 140 makes it very easy to create and send e-mails with still or video images taken with camera module 143.
[0073] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, the instant messaging module 141 includes executable instructions to enter a sequence of characters corresponding to an instant message, to modify previously entered characters, to transmit a respective instant message (for example, using a Short Message Service (SMS) or Multimedia Message Service (MMS) protocol for telephony-based instant messages or using XMPP, SIMPLE, or IMPS for Internet-based instant messages), to receive instant messages and to view received instant messages. In some embodiments, transmitted and/or received instant messages may include graphics, photos, audio files, video files and/or other attachments as are supported in a MMS and/or an Enhanced Messaging Service (EMS). As used herein, “instant messaging” refers to both telephony-based messages (e.g., messages sent using SMS or MMS) and Internet-based messages (e.g., messages sent using XMPP, SIMPLE, or IMPS).

[0074] In conjunction with RF circuitry 108, touch screen 112, display controller 156, contact module 130, graphics module 132, text input module 134, GPS module 135, map module 154, and music player module 146, workout support module 142 includes executable instructions to create workouts (e.g., with time, distance, and/or calorie burning goals); communicate with workout sensors (sports devices); receive workout sensor data; calibrate sensors used to monitor a workout; select and play music for a workout; and display, store and transmit workout data.

[0075] In conjunction with touch screen 112, display controller 156, optical sensor(s) 164, optical sensor controller 158, contact module 130, graphics module 132, and image management module 144, camera module 143 includes executable instructions to capture still images or video (including a video stream) and store them into memory 102, modify characteristics of a still image or video, or delete a still image or video from memory 102.

[0076] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, text input module 134, and camera module 143, image management module 144 includes executable instructions to arrange, modify (e.g., edit), or otherwise manipulate, label, delete, present (e.g., in a digital slide show or album), and store still and/or video images.

[0077] In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, audio circuitry 110, and speaker 111, video player module 145
includes executable instructions to display, present or otherwise play back videos (e.g., on touch screen 112 or on an external, connected display via external port 124).

[0078] In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, audio circuitry 110, speaker 111, RF circuitry 108, and browser module 147, music player module 146 includes executable instructions that allow the user to download and play back recorded music and other sound files stored in one or more file formats, such as MP3 or AAC files. In some embodiments, device 100 may include the functionality of an MP3 player, such as an iPod (trademark of Apple Inc.).

[0079] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, and text input module 134, browser module 147 includes executable instructions to browse the Internet in accordance with user instructions, including searching, linking to, receiving, and displaying web pages or portions thereof, as well as attachments and other files linked to web pages.

[0080] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, e-mail client module 140, and browser module 147, calendar module 148 includes executable instructions to create, display, modify, and store calendars and data associated with calendars (e.g., calendar entries, to do lists, etc.) in accordance with user instructions.

[0081] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, and browser module 147, widget modules 149 are mini-applications that may be downloaded and used by a user (e.g., weather widget 149-1, stocks widget 149-2, calculator widget 149-3, alarm clock widget 149-4, and dictionary widget 149-5) or created by the user (e.g., user-created widget 149-6). In some embodiments, a widget includes an HTML (Hypertext Markup Language) file, a CSS (Cascading Style Sheets) file, and a JavaScript file. In some embodiments, a widget includes an XML (Extensible Markup Language) file and a JavaScript file (e.g., Yahoo! Widgets).

[0082] In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, and browser module 147, the widget creator module 150 may be used by a user to create widgets (e.g., turning a user-specified portion of a web page into a widget).
In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, and text input module 134, search module 151 includes executable instructions to search for text, music, sound, image, video, and/or other files in memory 102 that match one or more search criteria (e.g., one or more user-specified search terms) in accordance with user instructions.

In conjunction with touch screen 112, display controller 156, contact module 130, graphics module 132, and text input module 134, notes module 153 includes executable instructions to create and manage notes, to do lists, and the like in accordance with user instructions.

In conjunction with RF circuitry 108, touch screen 112, display system controller 156, contact module 130, graphics module 132, text input module 134, GPS module 135, and browser module 147, map module 154 may be used to receive, display, modify, and store maps and data associated with maps (e.g., driving directions; data on stores and other points of interest at or near a particular location; and other location-based data) in accordance with user instructions.

In conjunction with touch screen 112, display system controller 156, contact module 130, graphics module 132, audio circuitry 110, speaker 111, RF circuitry 108, text input module 134, e-mail client module 140, and browser module 147, online video module 155 includes instructions that allow the user to access, browse, receive (e.g., by streaming and/or download), play back (e.g., on the touch screen or on an external, connected display via external port 124), send an e-mail with a link to a particular online video, and otherwise manage online videos in one or more file formats, such as H.264. In some embodiments, instant messaging module 141, rather than e-mail client module 140, is used to send a link to a particular online video. Additional description of the online video application can be found in U.S. Provisional Patent Application No. 60/936,562, "Portable Multifunction Device, Method, and Graphical User Interface for Playing Online Videos," filed June 20, 2007, and U.S. Patent Application No. 11/968,067, "Portable Multifunction Device, Method, and Graphical User Interface for Playing Online Videos," filed December 31, 2007, the content of which is hereby incorporated by reference in its entirety.

Each of the above identified modules and applications correspond to a set of executable instructions for performing one or more functions described above and the methods described in this application (e.g., the computer-implemented methods and other
information processing methods described herein). These modules (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules may be combined or otherwise re-arranged in various embodiments. For example, video player module 145 may be combined with music player module 146 into a single module (e.g., video and music player module 152, Figure 1B). In some embodiments, memory 102 may store a subset of the modules and data structures identified above. Furthermore, memory 102 may store additional modules and data structures not described above.

[0088] In some embodiments, device 100 is a device where operation of a predefined set of functions on the device is performed exclusively through a touch screen and/or a touchpad. By using a touch screen and/or a touchpad as the primary input control device for operation of device 100, the number of physical input control devices (such as push buttons, dials, and the like) on device 100 may be reduced.

[0089] The predefined set of functions that may be performed exclusively through a touch screen and/or a touchpad include navigation between user interfaces. In some embodiments, the touchpad, when touched by the user, navigates device 100 to a main, home, or root menu from any user interface that may be displayed on device 100. In such embodiments, the touchpad may be referred to as a "menu button." In some other embodiments, the menu button may be a physical push button or other physical input control device instead of a touchpad.

[0090] Figure 1C is a block diagram illustrating exemplary components for event handling in accordance with some embodiments. In some embodiments, memory 102 (in Figures 1A and IB) or 370 (Figure 3) includes event sorter 170 (e.g., in operating system 126) and a respective application 136-1 (e.g., any of the aforementioned applications 137-151, 155, 380-390).

[0091] Event sorter 170 receives event information and determines the application 136-1 and application view 191 of application 136-1 to which to deliver the event information. Event sorter 170 includes event monitor 171 and event dispatcher module 174. In some embodiments, application 136-1 includes application internal state 192, which indicates the current application view(s) displayed on touch sensitive display 112 when the application is active or executing. In some embodiments, device/global internal state 157 is used by event sorter 170 to determine which application(s) is(are) currently active, and
application internal state 192 is used by event sorter 170 to determine application views 191 to which to deliver event information.

[0092] In some embodiments, application internal state 192 includes additional information, such as one or more of: resume information to be used when application 136-1 resumes execution, user interface state information that indicates information being displayed or that is ready for display by application 136-1, a state queue for enabling the user to go back to a prior state or view of application 136-1, and a redo/undo queue of previous actions taken by the user.

[0093] Event monitor 171 receives event information from peripherals interface 118. Event information includes information about a sub-event (e.g., a user touch on touch-sensitive display 112, as part of a multi-touch gesture). Peripherals interface 118 transmits information it receives from I/O subsystem 106 or a sensor, such as proximity sensor 166, accelerometer(s) 168, and/or microphone 113 (through audio circuitry 110). Information that peripherals interface 118 receives from I/O subsystem 106 includes information from touch-sensitive display 112 or a touch-sensitive surface.

[0094] In some embodiments, event monitor 171 sends requests to the peripherals interface 118 at predetermined intervals. In response, peripherals interface 118 transmits event information. In other embodiments, peripheral interface 118 transmits event information only when there is a significant event (e.g., receiving an input above a predetermined noise threshold and/or for more than a predetermined duration).

[0095] In some embodiments, event sorter 170 also includes a hit view determination module 172 and/or an active event recognizer determination module 173.

[0096] Hit view determination module 172 provides software procedures for determining where a sub-event has taken place within one or more views, when touch sensitive display 112 displays more than one view. Views are made up of controls and other elements that a user can see on the display.

[0097] Another aspect of the user interface associated with an application is a set of views, sometimes herein called application views or user interface windows, in which information is displayed and touch-based gestures occur. The application views (of a respective application) in which a touch is detected may correspond to programmatic levels within a programmatic or view hierarchy of the application. For example, the lowest level view in which a touch is detected may be called the hit view, and the set of events that are
recognized as proper inputs may be determined based, at least in part, on the hit view of the initial touch that begins a touch-based gesture.

[0098] Hit view determination module 172 receives information related to sub-events of a touch-based gesture. When an application has multiple views organized in a hierarchy, hit view determination module 172 identifies a hit view as the lowest view in the hierarchy which should handle the sub-event. In most circumstances, the hit view is the lowest level view in which an initiating sub-event occurs (i.e., the first sub-event in the sequence of sub-events that form an event or potential event). Once the hit view is identified by the hit view determination module, the hit view typically receives all sub-events related to the same touch or input source for which it was identified as the hit view.

[0099] Active event recognizer determination module 173 determines which view or views within a view hierarchy should receive a particular sequence of sub-events. In some embodiments, active event recognizer determination module 173 determines that only the hit view should receive a particular sequence of sub-events. In other embodiments, active event recognizer determination module 173 determines that all views that include the physical location of a sub-event are actively involved views, and therefore determines that all actively involved views should receive a particular sequence of sub-events. In other embodiments, even if touch sub-events were entirely confined to the area associated with one particular view, views higher in the hierarchy would still remain as actively involved views.

[0100] Event dispatcher module 174 dispatches the event information to an event recognizer (e.g., event recognizer 180). In embodiments including active event recognizer determination module 173, event dispatcher module 174 delivers the event information to an event recognizer determined by active event recognizer determination module 173. In some embodiments, event dispatcher module 174 stores in an event queue the event information, which is retrieved by a respective event receiver module 182.

[0101] In some embodiments, operating system 126 includes event sorter 170. Alternatively, application 136-1 includes event sorter 170. In yet other embodiments, event sorter 170 is a stand-alone module, or a part of another module stored in memory 102, such as contact/motion module 130.

[0102] In some embodiments, application 136-1 includes a plurality of event handlers 190 and one or more application views 191, each of which includes instructions for handling touch events that occur within a respective view of the application's user interface. Each
application view 191 of the application 136-1 includes one or more event recognizers 180. Typically, a respective application view 191 includes a plurality of event recognizers 180. In other embodiments, one or more of event recognizers 180 are part of a separate module, such as a user interface kit (not shown) or a higher level object from which application 136-1 inherits methods and other properties. In some embodiments, a respective event handler 190 includes one or more of: data updater 176, object updater 177, GUI updater 178, and/or event data 179 received from event sorter 170. Event handler 190 may utilize or call data updater 176, object updater 177 or GUI updater 178 to update the application internal state 192. Alternatively, one or more of the application views 191 includes one or more respective event handlers 190. Also, in some embodiments, one or more of data updater 176, object updater 177, and GUI updater 178 are included in a respective application view 191.

[00103] A respective event recognizer 180 receives event information (e.g., event data 179) from event sorter 170, and identifies an event from the event information. Event recognizer 180 includes event receiver 182 and event comparator 184. In some embodiments, event recognizer 180 also includes at least a subset of: metadata 183, and event delivery instructions 188 (which may include sub-event delivery instructions).

[00104] Event receiver 182 receives event information from event sorter 170. The event information includes information about a sub-event, for example, a touch or a touch movement. Depending on the sub-event, the event information also includes additional information, such as location of the sub-event. When the sub-event concerns motion of a touch the event information may also include speed and direction of the sub-event. In some embodiments, events include rotation of the device from one orientation to another (e.g., from a portrait orientation to a landscape orientation, or vice versa), and the event information includes corresponding information about the current orientation (also called device attitude) of the device.

[00105] Event comparator 184 compares the event information to predefined event or sub-event definitions and, based on the comparison, determines an event or sub-event, or determines or updates the state of an event or sub-event. In some embodiments, event comparator 184 includes event definitions 186. Event definitions 186 contain definitions of events (e.g., predefined sequences of sub-events), for example, event 1 (187-1), event 2 (187-2), and others. In some embodiments, sub-events in an event 187 include, for example, touch begin, touch end, touch movement, touch cancellation, and multiple touching. In one example, the definition for event 1 (187-1) is a double tap on a displayed object. The double
tap, for example, comprises a first touch (touch begin) on the displayed object for a predetermined phase, a first lift-off (touch end) for a predetermined phase, a second touch (touch begin) on the displayed object for a predetermined phase, and a second lift-off (touch end) for a predetermined phase. In another example, the definition for event 2 (187-2) is a dragging on a displayed object. The dragging, for example, comprises a touch (or contact) on the displayed object for a predetermined phase, a movement of the touch across touch-sensitive display 112, and lift-off of the touch (touch end). In some embodiments, the event also includes information for one or more associated event handlers 190.

[00106] In some embodiments, event definition 187 includes a definition of an event for a respective user-interface object. In some embodiments, event comparator 184 performs a hit test to determine which user-interface object is associated with a sub-event. For example, in an application view in which three user-interface objects are displayed on touch-sensitive display 112, when a touch is detected on touch-sensitive display 112, event comparator 184 performs a hit test to determine which of the three user-interface objects is associated with the touch (sub-event). If each displayed object is associated with a respective event handler 190, the event comparator uses the result of the hit test to determine which event handler 190 should be activated. For example, event comparator 184 selects an event handler associated with the sub-event and the object triggering the hit test.

[00107] In some embodiments, the definition for a respective event 187 also includes delayed actions that delay delivery of the event information until after it has been determined whether the sequence of sub-events does or does not correspond to the event recognizer's event type.

[00108] When a respective event recognizer 180 determines that the series of sub-events do not match any of the events in event definitions 186, the respective event recognizer 180 enters an event impossible, event failed, or event ended state, after which it disregards subsequent sub-events of the touch-based gesture. In this situation, other event recognizers, if any, that remain active for the hit view continue to track and process sub-events of an ongoing touch-based gesture.

[00109] In some embodiments, a respective event recognizer 180 includes metadata 183 with configurable properties, flags, and/or lists that indicate how the event delivery system should perform sub-event delivery to actively involved event recognizers. In some embodiments, metadata 183 includes configurable properties, flags, and/or lists that indicate
how event recognizers may interact with one another. In some embodiments, metadata 183 includes configurable properties, flags, and/or lists that indicate whether sub-events are delivered to varying levels in the view or programmatic hierarchy.

[00110] In some embodiments, a respective event recognizer 180 activates event handler 190 associated with an event when one or more particular sub-events of an event are recognized. In some embodiments, a respective event recognizer 180 delivers event information associated with the event to event handler 190. Activating an event handler 190 is distinct from sending (and deferred sending) sub-events to a respective hit view. In some embodiments, event recognizer 180 throws a flag associated with the recognized event, and event handler 190 associated with the flag catches the flag and performs a predefined process.

[00111] In some embodiments, event delivery instructions 188 include sub-event delivery instructions that deliver event information about a sub-event without activating an event handler. Instead, the sub-event delivery instructions deliver event information to event handlers associated with the series of sub-events or to actively involved views. Event handlers associated with the series of sub-events or with actively involved views receive the event information and perform a predetermined process.

[00112] In some embodiments, data updater 176 creates and updates data used in application 136-1. For example, data updater 176 updates the telephone number used in contacts module 137, or stores a video file used in video player module 145. In some embodiments, object updater 177 creates and updates objects used in application 136-1. For example, object updater 176 creates a new user-interface object or updates the position of a user-interface object. GUI updater 178 updates the GUI. For example, GUI updater 178 prepares display information and sends it to graphics module 132 for display on a touch-sensitive display.

[00113] In some embodiments, event handler(s) 190 includes or has access to data updater 176, object updater 177, and GUI updater 178. In some embodiments, data updater 176, object updater 177, and GUI updater 178 are included in a single module of a respective application 136-1 or application view 191. In other embodiments, they are included in two or more software modules.

[00114] It shall be understood that the foregoing discussion regarding event handling of user touches on touch-sensitive displays also applies to other forms of user inputs to operate multifunction devices 100 with input-devices, not all of which are initiated on touch
screens, e.g., coordinating mouse movement and mouse button presses with or without single or multiple keyboard presses or holds, user movements taps, drags, scrolls, etc., on touchpads, pen stylus inputs, movement of the device, oral instructions, detected eye movements, biometric inputs, and/or any combination thereof, which may be utilized as inputs corresponding to sub-events which define an event to be recognized.

[00115] Figure 2 illustrates a portable multifunction device 100 having a touch screen 112 in accordance with some embodiments. The touch screen may display one or more graphics within user interface (UI) 200. In this embodiment, as well as others described below, a user may select one or more of the graphics by making contact or touching the graphics, for example, with one or more fingers 202 (not drawn to scale in the figure) or one or more styluses 203 (not drawn to scale in the figure). In some embodiments, selection of one or more graphics occurs when the user breaks contact with the one or more graphics. In some embodiments, the contact may include a gesture, such as one or more taps, one or more swipes (from left to right, right to left, upward and/or downward) and/or a rolling of a finger (from right to left, left to right, upward and/or downward) that has made contact with device 100. In some embodiments, inadvertent contact with a graphic may not select the graphic. For example, a swipe gesture that sweeps over an application icon may not select the corresponding application when the gesture corresponding to selection is a tap.

[00116] Device 100 may also include one or more physical buttons, such as "home" or menu button 204. As described previously, menu button 204 may be used to navigate to any application 136 in a set of applications that may be executed on device 100. Alternatively, in some embodiments, the menu button is implemented as a soft key in a GUI displayed on touch screen 112.

[00117] In one embodiment, device 100 includes touch screen 112, menu button 204, push button 206 for powering the device on/off and locking the device, volume adjustment button(s) 208, Subscriber Identity Module (SIM) card slot 210, head set jack 212, and docking/charging external port 124. Push button 206 may be used to turn the power on/off on the device by depressing the button and holding the button in the depressed state for a predefined time interval; to lock the device by depressing the button and releasing the button before the predefined time interval has elapsed; and/or to unlock the device or initiate an unlock process. In an alternative embodiment, device 100 also may accept verbal input for activation or deactivation of some functions through microphone 113.
Figure 3 is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments. Device 300 need not be portable. In some embodiments, device 300 is a laptop computer, a desktop computer, a tablet computer, a multimedia player device, a navigation device, an educational device (such as a child's learning toy), a gaming system, or a control device (e.g., a home or industrial controller). Device 300 typically includes one or more processing units (CPU's) 310, one or more network or other communications interfaces 360, memory 370, and one or more communication buses 320 for interconnecting these components. Communication buses 320 may include circuitry (sometimes called a chipset) that interconnects and controls communications between system components. Device 300 includes input/output (I/O) interface 330 comprising display 340, which is typically a touch screen display. I/O interface 330 also may include a keyboard and/or mouse (or other pointing device) 350 and touchpad 355. Memory 370 includes high-speed random access memory, such as DRAM, SRAM, DDR RAM or other random access solid state memory devices; and may include non-volatile memory, such as one or more magnetic disk storage devices, optical disk storage devices, flash memory devices, or other non-volatile solid state storage devices. Memory 370 may optionally include one or more storage devices remotely located from CPU(s) 310. In some embodiments, memory 370 stores programs, modules, and data structures analogous to the programs, modules, and data structures stored in memory 102 of portable multifunction device 100 (Figure 1), or a subset thereof. Furthermore, memory 370 may store additional programs, modules, and data structures not present in memory 102 of portable multifunction device 100. For example, memory 370 of device 300 may store drawing module 380, presentation module 382, word processing module 384, website creation module 386, disk authoring module 388, and/or spreadsheet module 390, while memory 102 of portable multifunction device 100 (Figure 1) may not store these modules.

Each of the above identified elements in Figure 3 may be stored in one or more of the previously mentioned memory devices. Each of the above identified modules corresponds to a set of instructions for performing a function described above. The above identified modules or programs (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules may be combined or otherwise re-arranged in various embodiments. In some embodiments, memory 370 may store a subset of the modules and data structures identified
above. Furthermore, memory 370 may store additional modules and data structures not described above.

[00120] Attention is now directed towards embodiments of user interfaces ("UI") that may be implemented on portable multifunction device 100.

[00121] Figures 4A and 4B illustrate exemplary user interfaces for a menu of applications on portable multifunction device 100 in accordance with some embodiments. Similar user interfaces may be implemented on device 300. In some embodiments, user interface 400A includes the following elements, or a subset or superset thereof:

- Signal strength indicator(s) 402 for wireless communication(s), such as cellular and Wi-Fi signals;
- Time 404;
- Bluetooth indicator 405;
- Battery status indicator 406;
- Tray 408 with icons for frequently used applications, such as:
  - Phone 138, which may include an indicator 414 of the number of missed calls or voicemail messages;
  - E-mail client 140, which may include an indicator 410 of the number of unread e-mails;
  - Browser 147; and
  - Music player 146; and
- Icons for other applications, such as:
  - IM 141;
  - Image management 144;
  - Camera 143;
  - Video player 145;
  - Weather 149-1;
  - Stocks 149-2;
  - Workout support 142;
o Calendar 148;
o Calculator 149-3;
o Alarm clock 149-4;
o Dictionary 149-5; and
o User-created widget 149-6.

[00122] In some embodiments, user interface 400B includes the following elements, or a subset or superset thereof:

. 402, 404, 405, 406, 141, 148, 144, 143, 149-3, 149-1, 149-4, 410, 414, 138, 140, and 147, as described above;

• Map 154;
• Notes 153;
• Settings 412, which provides access to settings for device 100 and its various applications 136, as described further below;
• Video and music player module 152, also referred to as iPod (trademark of Apple Inc.) module 152; and
• Online video module 155, also referred to as YouTube (trademark of Google Inc.) module 155.

[00123] Figure 4C illustrates an exemplary user interface on a device (e.g., device 300, Figure 3) with a touch-sensitive surface 451 (e.g., a tablet or touchpad 355, Figure 3) that is separate from the display 450 (e.g., touch screen display 112). Although many of the examples which follow will be given with reference to inputs on touch screen display 112 (where the touch sensitive surface and the display are combined), in some embodiments, the device detects inputs on a touch-sensitive surface that is separate from the display, as shown in Figure 4C. In some embodiments the touch sensitive surface (e.g., 451 in Figure 4C) has a primary axis (e.g., 452 in Figure 4C) that corresponds to a primary axis (e.g., 453 in Figure 4C) on the display (e.g., 450). In accordance with these embodiments, the device detects contacts (e.g., 460 and 462 in Figure 4C) with the touch-sensitive surface 451 at locations that correspond to respective locations on the display (e.g., in Figure 4C 460 corresponds to 468 and 462 corresponds to 470). In this way, user inputs (e.g., contacts 460 and 462, and movements thereof) detected by the device on the touch-sensitive surface (e.g., 451 in Figure
4C) are used by the device to manipulate the user interface on the display (e.g., 450 in Figure 4C) of the multifunction device when the touch-sensitive surface is separate from the display. It should be understood that similar methods may be used for other user interfaces described herein.

[00124] Additionally, while the following examples are given primarily with reference to finger inputs (e.g., finger contacts, finger tap gestures, finger swipe gestures), it should be understood that, in some embodiments, one or more of the finger inputs are replaced with input from another input device (e.g., a mouse based input or stylus input). For example, a swipe gesture may be replaced with a mouse click (e.g., instead of a contact) followed by movement of the cursor along the path of the swipe (e.g., instead of movement of the contact). As another example, a tap gesture may be replaced with a mouse click while the cursor is located over the location of the tap gesture (e.g., instead of detection of the contact followed by ceasing to detect the contact). Similarly, when multiple user inputs are simultaneously detected, it should be understood that multiple computer mice may be used simultaneously, or a mouse and finger contacts may be used simultaneously.

[00125] Attention is now directed towards embodiments of user interfaces ("UI") and associated processes that may be implemented on a multifunction device with a display and a touch-sensitive surface, such as device 300 or portable multifunction device 100.

[00126] Figures 5A-5J illustrate exemplary user interfaces for reordering the front-to-back positions of user interface objects in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in Figures 6A-6D.

[00127] Figures 5A-5B illustrate exemplary user interfaces for displaying object order indicators in response to detecting an input. In Figure 5A a plurality of objects 5002 are displayed on the display (e.g., touch screen 112). The objects have a first layer order (e.g., the objects are arranged from front to back in the following order: object 5002-1, object 5002-2, object 5002-3, object 5002-4, object 5002-5, object 5002-6). The device detects a first contact 5004 at a location on the touch-sensitive surface (e.g., touch screen 112) that corresponds to a location of one of the objects 5002-3 on the display and displays object order indicators 5005, as illustrated in Figure 5B. In some embodiments, the object order indicators are only displayed after detecting a second contact (e.g., contact 5006, Figure 5B) on the touch-sensitive surface while the first contact 5004 is detected.
[00128] Figures 5B-5D illustrate exemplary user interfaces for reordering a respective object. In Figure 5B, after detecting the first contact 5004 at a location that corresponds to a respective object 5002-3, the device detects a second contact 5006 and a gesture that includes movement of the second contact upwards (e.g., from a respective location 5006-a in Figure 5B to a first updated location 5006-b in Figure 5C to a second updated location 5006-c in Figure 5D) on the touch-sensitive surface (e.g., touch screen 112). In some embodiments, in response to detecting the second contact, the device maps regions 5008 of the touch-sensitive surface (e.g., touch screen 112) to positions in the first layer order (e.g., region 5008-1 is mapped to the first position, region 5008-2 is mapped to the second position, region 5008-3 is mapped to the third position, region 5008-4 is mapped to the fourth position, region 5008-5 is mapped to the fifth position, and region 5008-6 is mapped to the sixth position). When the contact moves into a new region, the respective object 5002-3 is moved to a position in the layer order that corresponds to the new region. Thus, in Figure 5C, when the second contact 5006-b is located in a region 5008-2 that corresponds to the second position, the device moves the respective object 5002-3 to the second position and updates the object order indicator 5005-3 accordingly (e.g., changing the object order indicator from "3" to "2"). Similarly, in Figure 5D, when the second contact 5006-c is located in a region 5008-1 that corresponds to the first position, the device moves the respective object 5002-3 to the first position and updates the object order indicator 5005-3 accordingly (e.g., changing the object order indicator from "2" to "1").

[00129] Figures 5E-5F illustrate exemplary user interfaces for displaying object order indicators in response to detecting an input. In Figure 5E, a plurality of objects 5002 are displayed on the display (e.g., touch screen 112), the objects have a first layer order (e.g., the objects are arranged from front to back in the following order: object 5002-3, object 5002-1, object 5002-2, object 5002-4, object 5002-5, object 5002-6). The device detects a first contact 5010 at a location on the touch-sensitive surface (e.g., touch screen 112) that corresponds to a location of one of the objects 5002-5 on the display (e.g., touch screen 112) and displays object order indicators 5005, as illustrated in Figure 5F. In some embodiments, the object order indicators are only displayed after detecting a second contact 5012 on the touch-sensitive surface while the first contact 5010 is detected.

[00130] Figures 5F-5H illustrate exemplary user interfaces for reordering multiple objects. In Figure 5F, after detecting the first contact 5010 at a location that corresponds to a respective object 5002-5 while multiple objects (e.g., object 5002-2, object 5002-5, and
object 5002-6) are simultaneously selected, the device detects a second contact 5012 and a
gesture that includes movement of the second contact upwards (e.g., from a respective
location 5012-a in Figure 5F to an updated location 5012-b in Figure 5G to a second updated
location 5012-c in Figure 5H) on the touch-sensitive surface. In some embodiments, in
response to detecting the second contact, the device maps regions 5008 of the touch-sensitive
surface (e.g., touch screen 112) to positions in the first layer order (e.g., region 5008-1 is
mapped to the first position, region 5008-2 is mapped to the second position, region 5008-3 is
mapped to the third position, region 5008-4 is mapped to the fourth position, region 5008-5 is
mapped to the fifth position, and region 5008-6 is mapped to the sixth position). When the
contact moves into a new region, the respective object 5002-5 is moved to a position in the
layer order that corresponds to the new region, and the other selected objects (e.g., object
5002-2 and object 5002-6) are moved within the layer order in accordance with the
movement of the second contact 5012.

[00131] Thus, in Figure 5G, when the second contact 5012-b is located in a region
5008-4 that corresponds to the fourth position, the device moves the respective object 5002-5
to the fourth position and updates the object order indicator 5005-5 accordingly (e.g.,
changing the object order indicator from "5" to "4"). The device also reorders the other
selected objects (e.g., object 5002-2 and object 5002-6) in accordance with the gesture (e.g.,
object 5002-2 is moved to the second position and object 5002-6 is moved to the fifth
position), and the object order indicators (e.g., 5005-2 and 5005-6) for the other selected
objects are updated accordingly. Similarly, in Figure 5H, when the second contact 5012-c is
located in a region 5008-3 that corresponds to the third position, the device moves the
respective object 5002-5 to the third position and updates the object order indicator 5005-5
accordingly (e.g., changing the object order indicator from "4" to "3"). The device also
reorders the other selected objects (e.g., object 5002-2 and object 5002-6) in accordance with
the gesture (e.g., object 5002-2 is moved to the first position and object 5002-6 is moved to
the fourth position), and the object order indicators (e.g., 5005-2 and 5005-6) for the other
selected objects are updated accordingly.

[00132] Figures 5F and 5I-5J illustrate exemplary user interfaces for reordering
multiple objects. In Figure 5F, after detecting the first contact 5010 at a location that
corresponds to a respective object 5002-5 while multiple objects (e.g., object 5002-2, object
5002-5, and object 5002-6) are simultaneously selected, the device detects a second contact
5012 and a gesture that includes movement of the second contact upwards (e.g., from a
respective location 5012-a in Figure 5F to location 5012-d in Figure 5I to updated location 5012-e in Figure 5J) on the touch-sensitive surface (e.g., touch screen 112). In some embodiments, in response to detecting the second contact, the device maps regions 5008 of the touch-sensitive surface (e.g., touch screen 112) to positions in the first layer order (e.g., region 5008-1 is mapped to the first position, region 5008-2 is mapped to the second position, region 5008-3 is mapped to the third position, region 5008-4 is mapped to the fourth position, region 5008-5 is mapped to the fifth position, and region 5008-6 is mapped to the sixth position). Even before the second contact 5012 moves into a new region, the selected objects move to consecutive positions (e.g., object 5002-2 moves to the fourth position, so that the selected objects 5002-2, 5002-5, and 5002-6 are on the fourth, fifth, and sixth positions, respectively, as illustrated in Figure 5I). When the contact 5012 moves into a new region, the respective object 5002-3 is moved to a position in the layer order that corresponds to the new region, and the other selected objects (e.g., object 5002-2 and object 5002-6) are moved within the layer order in accordance with the movement of the second contact 5012.

[00133] Thus, in Figure 5J, when the second contact 5012-e is located in a region 5008-3 that corresponds to the third position, the device moves the respective object 5002-5 to the third position and updates the object order indicator 5005-5 accordingly (e.g., changing the object order indicator from "5" to "3"). The device also reorders the other selected objects (e.g., object 5002-2 and object 5002-6) in accordance with the gesture (e.g., object 5002-2 is moved to the second position and object 5002-6 is moved to the fourth position), and the object order indicators (e.g., 5005-2 and 5005-6) for the other selected objects are updated accordingly.

[00134] Figures 6A-6D are flow diagrams illustrating a method 600 of reordering the front-to-back positions of user interface objects in accordance with some embodiments. The method 600 is performed at a multifunction device (e.g., device 300, Figure 3, or portable multifunction device 100, Figure 1) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method 600 may be combined and/or the order of some operations may be changed.

[00135] As described below, the method 600 provides an intuitive way to reorder the front-to-back positions of user interface objects. The method reduces the cognitive burden on a user when changing the z-order of objects, thereby creating a more efficient human-
machine interface. For battery-operated computing devices, enabling a user to reorder the front-to-back positions of objects in a user interface faster and more efficiently conserves power and increases the time between battery charges.

[00136] The device displays (602) a plurality of objects (e.g., 5002 in Figure 5A) on the display. The plurality of objects has a first layer order (e.g., the object 5002-1 is in front, object 5002-2 is second from the front, 5002-3 is third from the front, object 5002-4 is fourth from the front, object 5002-5 is fifth from the front, and object 5002-6 is in back in Figures 5A-5B). As used in the specification and claims, a "layer order" is the front-to-back order of objects in a user interface (e.g., in an electronic document). Thus, if two objects overlap, the object that is higher in the layer order (e.g., the object that is "on top of" or "in front of") is displayed at any points where the two objects overlap, thereby partially obscuring the object that is lower in the layer order (e.g., the object that is "beneath" or "behind" or "in back of the other object). For example, in Figure 5A circular object 5002-1 is in front of star-shaped object 5002-2, and therefore the point of the star that overlaps with the circle is hidden from view, because it is "behind" the circular object 5002-1. As another example, in Figure 5A the star-shaped object 5002-2 is in front of triangular object 5002-3, and therefore the points of the star that overlap with the triangle are shown, because the triangle is "behind" the star-shaped object 5002-2. As noted above, "layer order" is also called a "z order" or "front-to-back order" of the objects.

[00137] In some embodiments, the objects are objects on a canvas in an electronic document authoring application (e.g., a presentation application, a spreadsheet application, a word processing application, a graphical image manipulation application, a desktop publishing application, etc.). Additionally, while the examples described herein are described primarily with reference to simple shape and text objects so as not to unnecessarily obscure relevant aspects of the disclosed embodiments, it should be understood that the objects 5002 may be virtually any objects that are displayed on a display of a multifunction device (e.g., icons, images, videos, tables, etc.) that have a layer order.

[00138] In some embodiments, the device detects (604) an input that meets object order indicator display criteria. In some embodiments, the input that meets the object order indicator display criteria is a tap and hold gesture (e.g., 5004 in Figure 5A) at a location on a touch-sensitive surface (e.g., touch screen 112) that corresponds to a location of an object (e.g., 5002-3 in Figure 5A) on the display (e.g., touch screen 112). In some embodiments, the tap and hold gesture must be maintained for a predefined time threshold (e.g., 0.2 seconds,
0.5 seconds, 1 second, 2 seconds, or any reasonable time period) in order to meet the object order indicator display criteria. In some embodiments, the input that meets the object order indicator display criteria includes a first contact (e.g., 5004 in Figure 5A) at a location on a touch-sensitive surface (e.g., touch screen 112) that corresponds to a location of an object (e.g., 5002-3 in Figure 5A) on the display (e.g., touch screen 112) and, concurrent with the first contact, a second contact (e.g., 5006-a in Figure 5B) that is not at (e.g., is away from) a location on a touch-sensitive surface (e.g., touch screen 112) that corresponds to a location of any object (e.g., 5002 in Figure 5B) on the display (e.g., touch screen 112). In some embodiments, first contact and/or the second contact must be maintained for a predefined time threshold (e.g., 0.2 seconds, 0.5 seconds, 1 second, 2 seconds, 5 seconds, or any reasonable time period) in order to meet the object order indicator display criteria. Additionally, it should be understood that, in accordance with some embodiments, the first contact and/or the second contact must remain in a substantially stationary position on the touch-sensitive surface for a time that is greater than or equal to the predefined time threshold (e.g., the first contact does not move more than a predefined distance on the touch sensitive surface for at least 0.2 seconds, 0.5 seconds, 1 second, 2 seconds, 5 seconds, etc) in order to meet the object order indicator display criteria.

[00139] In some embodiments, the device displays (606), for each respective object 5002 in at least a subset of the plurality of objects, a respective object order indicator 5005. The respective object order indicator for a respective object provides a visual indication of a position of the respective object within the first layer order. For example, the object order indicator 5005-1 for the circular object 5002-1 indicates that the circular object 5002-1 is at the front of the layer order, while the object order indicator 5005-2 for the star-shaped object 5002-2 indicates that the star-shaped object 5002-2 is second from the front of the layer order, etc. It should be understood that, in some embodiments, object order indicators are displayed for all objects. In some other embodiments, object order indicators are only displayed for a subset of the objects (e.g., object order indicators are only displayed for the selected objects). In some embodiments, the object order indicators are displayed (608) in response to detecting the input that meets object order indicator display criteria (e.g., detecting the first contact 5004 at a location on the touch-sensitive surface that corresponds to a respective object and detecting the second contact 5006 on the touch-sensitive surface for more than a predetermined period of time).
The device detects (610) a first contact at a location on the touch-sensitive surface that corresponds to a location of a respective object on the display. For example, in Figures 5A-5D the device detects a contact 5004 at a location on the touch-sensitive surface (e.g., touch screen 112) that corresponds to a location of the triangular object 5002-3 on the display (e.g., touch screen 112). As another example, in Figures 5E-5J the device detects a contact 5010 at a location on the touch-sensitive surface (e.g., touch screen 112) that corresponds to a location of the rectangular object 5002-5 on the display (e.g., touch screen 112). In some embodiments, the device selects (612) multiple objects, including the respective object. For example, in Figures 5F-5J, three objects (e.g., 5002-2, 5002-5, and 5002-6) are simultaneously selected. While the first contact is typically detected at a location of a respective object of the plurality of objects on the display, it should be understood that, in some embodiments the first contact is detected at a location on the touch-sensitive surface that corresponds to a predefined object-reordering region (e.g., an object reordering region that is associated with a particular object or a particular set of objects) on the display. Additionally, it should be understood that in other embodiments, the respective object is detected independently of the gesture (e.g., the respective object is a previously selected object) and the respective object is reordered in accordance with a gesture that is associated with object reordering. For example, while a respective object is selected, the device detects an n-finger (e.g., two-finger) swipe gesture in a predefined direction (e.g., up or down) on the touch-sensitive surface, and in response to detecting the n-finger swipe gesture the respective object is moved within the object layer order (e.g., "z-order") in accordance with the n-finger swipe gesture.

While detecting the first contact, the device detects (614) a gesture that includes a second contact on the touch-sensitive surface. For example, in Figure 5B, the device detects a second contact 5006 and subsequent movement of the contact from a respective location 5006-a on the touch-sensitive surface to an updated location 5006-b on the touch-sensitive surface, as illustrated in Figure 5C. As another example, in Figure 5F, the device detects a second contact 5012 and subsequent movement of the contact from a respective location 5012-a on the touch-sensitive surface to an updated location 5012-b on the touch-sensitive surface, as illustrated in Figure 5G.

In some embodiments, the gesture meets (616) predetermined object-reordering criteria. The predetermined object reordering criteria include that the second contact is maintained for more than a predetermined threshold amount of time at a location
on the touch-sensitive surface that corresponds to a portion of the display that is apart from any objects in the plurality of objects (e.g., away from any objects in the plurality of objects or does not include any of the plurality of objects); and, after the second contact is maintained for more than the predetermined threshold amount of time, movement of the second contact is detected on the touch-sensitive surface that is above a threshold amount of movement. For example, in Figure 5B the device determines that the second contact 5006 has been maintained on the touch-sensitive surface for more than a predetermined time threshold (e.g., 0.2 seconds, 0.5 seconds, 1 second, 2 seconds, 5 seconds, or any reasonable time period), and subsequently detects that the second contact 5006 has been moved more than a threshold distance (e.g., 10 pixels, 25 pixels, 50 pixels, 100 pixels, or any reasonable distance given the size of the touch-sensitive surface). As another example, in Figure 5F the device determines that the second contact 5012 has been maintained on the touch-sensitive surface for more than a predetermined time threshold (e.g., 0.2 seconds, 0.5 seconds, 1 second, 2 seconds, 5 seconds, or any reasonable time period), and subsequently detects that the second contact 5010 has been moved more than a threshold distance (e.g., 10 pixels, 25 pixels, 50 pixels, 100 pixels, or any reasonable distance given the size and resolution of the display). Additionally, it should be understood that, in accordance with some embodiments, the first contact and/or the second contact must remain in a substantially stationary position on the touch-sensitive surface for a time that is greater than or equal to the predefined time threshold (e.g., the first contact does not move more than a predefined distance on the touch sensitive surface for at least 0.2 seconds, 0.5 seconds, 1 second, 2 seconds, 5 seconds, etc) in order to meet the object order indicator display criteria.

[00143] In response to detecting the gesture (e.g., the gesture meets that predetermined object-reordering criteria), the device reorders (618) the plurality of objects in accordance with the gesture so as to create a second layer order that is different from the first layer order. For example, in Figure 5B, before detecting the gesture (e.g., including movement of contact 5006 from a respective location 5006-a to an updated location 5006-b), the objects have a first layer order where the objects are arranged from front to back as follows: object 5002-1, object 5002-2, object 5002-3, object 5002-4, object 5002-5, and object 5002-6; whereas, after detecting the gesture, the objects have a second layer order where the objects are arranged from front to back as follows: object 5002-1, object 5002-3, object 5002-2, object 5002-4, object 5002-5, and object 5002-6 (e.g., object 5002-3 has moved one position "up" or "to the front" in the layer order), as illustrated in Figure 5C. Continuing with this example, in Figure
5C, the device detects a continuation of the gesture (e.g., including movement of contact 5006 from a respective location 5006-b to an updated location 5006-c), which further reorders the objects from front to back as follows: object 5002-3, object 5002-1, object 5002-2, object 5002-4, object 5002-5, and object 5002-6 (e.g., object 5002-3 has moved one more position "up" or "to the front" in the layer order), as illustrated in Figure 5D.

[00144] In some embodiments, the position of the respective object within the first layer order is (620) different from the position of the respective object within the second layer order. For example, in Figure 5B the triangular object 5002-3 is in the third position from the front, while in Figure 5C the triangular object 5002-3 is in the second position from the front, and in Figure 5D the triangular object 5002-3 is in the front position.

[00145] In some embodiments, multiple objects (e.g., 5002-2, 5002-5, and 5002-6 in Figures 5F-5J), including the respective object (e.g., 5002-5 in Figure 5F), are selected objects when the gesture is detected, and a position of each of the selected objects within the first layer order is (622) different from a position of each of the selected objects within the second layer order. For example, in Figure 5F, before detecting the gesture (e.g., including movement of contact 5012 from a respective location 5012-a to an updated location 5102-b), the objects have a first layer order where the objects are arranged from front to back as follows: object 5002-3, object 5002-1, object 5002-2, object 5002-4, object 5002-5, and object 5002-6; whereas, after detecting the gesture, the objects have a second layer order where the objects are arranged from front to back as follows: object 5002-3, object 5002-2, object 5002-1, object 5002-5, object 5002-6, and object 5002-4. In other words, in this example, each of the selected objects 5002-2, 5002-5, and 5002-6 has moved one position "forward" or "upwards" in the layer order, as illustrated in Figure 5G. Continuing with this example, in Figure 5G, the device detects a continuation of the gesture (e.g., including movement of contact 5012 from a respective location 5012-b to an updated location 5102-c), which further reorders the objects from front to back as follows: object 5002-2, object 5002-3, object 5002-5, object 5002-6, object 5002-1, and object 5002-4. In other words, in this continuing example, each of the selected objects 5002-2, 5002-5 and 5002-6 has moved one more position "forwards" or "upwards" in the layer order, as illustrated in Figure 5H.

[00146] In some embodiments, in the first layer order, each of the selected objects has (624) a relative position with respect to the other selected objects; and in the second layer order, each of the selected objects has the same relative position with respect to the other selected objects. For example, in Figure 5F, before the gesture (e.g., including movement of
the second contact 5006 from a respective location 5006-a to an updated location 5006-b) is
detected, object 5002-2 is two positions in front of object 5002-5 and object 5002-5 is one
position in front of object 5002-6, and in Figure 5G, after the reordering, object 5002-2 is still
two positions in front of object 5002-5 and object 5002-5 is still one position in front of
object 5002-6.

[00147] In some embodiments, in the first layer order, an object in the plurality of
objects that is not selected has (626) a position that is between two of the selected objects;
and in the second layer order, the two selected objects are consecutively ordered (i.e., the
non-selected object is no longer between the selected objects in the layer order). In other
words, in some embodiments, in response to detecting the reordering gesture while multiple
objects are selected, the multiple selected objects move to consecutive positions, and move as
a group. For example, in Figure 5F, before detecting the gesture (e.g., including movement
of contact 5012 from a respective location 5012-a to an updated location 5102-e in Figure
5J), the objects have a first layer order where the objects are arranged from front to back as
follows: object 5002-3, object 5002-1, object 5002-2, object 5002-4, object 5002-5, and
object 5002-6. In this example, after detecting the beginning of the reordering gesture, the
objects are moved to consecutive positions so that the objects have an updated layer order
where the objects are arranged from front to back as follows: object 5002-3, object 5002-1,
object 5002-4, object 5002-2, object 5002-5, and object 5002-6 (e.g., see Figure 5I, where all
of the selected objects have moved within the layer order so that they are on consecutive
layers). Continuing this example, after detecting a continuation of the gesture (e.g.,
movement of the second contact 5012 from a respective location 5012-d to an updated
location 5012-e in Figure 5J) the objects have a second layer order where the objects are
arranged from front to back as follows: object 5002-3, object 5002-2, object 5002-5, object
5002-6, object 5002-1, and object 5002-4. In other words, in this example, the selected
objects have been moved to consecutive positions in the layer order (e.g., the second, third,
and fourth positions from the front), and the respective object has been moved forward by
two positions (e.g., from the fifth position from the front to the third position from the front),
as illustrated in Figure 5J.

[00148] When an object order indicator (e.g., 5005-3 in Figures 5B-5D) that provides a
visual indication of a position of the respective object (e.g., 5002-3 in Figures 5B-5D) within
the first layer order is displayed for each respective object in at least a subset of the objects,
in response to detecting the gesture, the device updates (628) the respective object order
indicator for the respective object, so that the respective object order indicator provides a visual indication of a position of the respective object within the second layer order. For example, in Figure 5B, the object order indicator 5005-3 for the respective object 5002-3 includes a "3," which indicates that the respective object 5002-3 is at the third position from the front in the first layer order, whereas in Figure 5C, after the objects have been reordered to the second layer order, the object order indicator 5005-3 for the respective object 5002-3 includes a "2," which indicates that the respective object 5002-3 is at the second position from the front in the second layer order.

[00149] In some embodiments, object order indicators are updated for each of the objects that changed their position within the layer order as a result of the gesture (e.g., all of the objects that were selected and any objects whose position was changed due to the movement of other objects). For example, in Figure 5F, the object order indicator 5005-1 for object 5002-1 includes a "2" indicating that the respective object 5002-1 is at the second position from the front in the first layer order; the object order indicator 5005-2 for object 5002-2 includes a "3" indicating that the respective object 5002-2 is at the third position from the front in the first layer order; the object order indicator 5005-3 for object 5002-3 includes a "1" indicating that the respective object 5002-3 is at the front in the first layer order; the object order indicator 5005-4 for object 5002-4 includes a "4" indicating that the respective object 5002-4 is at the fourth position from the front in the first layer order; the object order indicator 5005-5 for object 5002-5 includes a "5" indicating that the respective object 5002-5 is at the fifth position from the front in the first layer order; and the object order indicator 5005-6 for object 5002-6 includes a "6" indicating that the respective object 5002-6 is at the sixth position from the front (i.e., the back position) in the first layer order. Continuing this example, in Figure 5C, after the objects have been reordered to the second layer order, the object order indicator 5005-1 for object 5002-1 has been updated from "2" to "3" indicating that the respective object 5002-1 is now at the third position from the front in the second layer order; the object order indicator 5005-2 for object 5002-2 has been updated from "3" to "2" indicating that the respective object 5002-2 is now at the second position from the front in the second layer order; the object order indicator 5005-4 for object 5002-4 has been updated from "4" to "6" indicating that the respective object 5002-4 is now at the sixth position from the front (i.e., the back position) in the second layer order; the object order indicator 5005-5 for object 5002-5 has been updated from "5" to "4" indicating that the respective object 5002-5 is now at the fourth position from the front in the second layer order;
and the object order indicator 5005-6 for object 5002-6 has been updated from "6" to "5" indicating that the respective object 5002-6 is now at the fifth position from the front in the second layer order.

[00150] In some embodiments, the gesture includes movement of the second contact on the touch-sensitive surface; and the second layer order is determined (630) in accordance with a component of the movement of the second contact that corresponds to a predetermined axis of the display. In some embodiments, the predetermined axis is a vertical axis on the display (e.g., an axis perpendicular to the primary axis 458 illustrated in Figure 4C). For example, in Figures 5B-5C, the second contact 5006 moves upwards (e.g., from a respective location 5006-a in Figure 5B to an updated location 5006-b in Figure 5C). However, it should be understood that, in accordance with these embodiments, if the contact were to move diagonally, only the vertical component of movement of the contact would be used to determine the magnitude of the movement of the second contact. In some embodiments, the predetermined axis is determined based on accelerometer data to be the axis of the device that is the current up/down axis for the user based on the current orientation of the device relative to the ground (e.g., an axis between a top edge of the device and a bottom edge of the device, where the bottom edge is closer to the ground than the top edge).

[00151] In some embodiments, when the component of movement of the second contact that corresponds to the predetermined axis of the display is (632) in a first direction (e.g., upwards), a position of the respective object in the second layer order is higher than a position of the respective object in the first layer order; and when the component of movement of the second contact that corresponds to the predetermined axis of the display is in a second direction (e.g., downwards) that is opposite (or substantially opposite) to the first direction, a position of the respective object in the second layer order is lower than the position of the respective object in the first layer order. In other words, in these embodiments, when the second contact moves upwards on the display, the selected object(s) are moved forwards in the layer order (e.g., towards the top of the layer order), while when the second contact moves downwards on the display, the second object(s) are moved backwards in the layer order (e.g., towards the bottom of the layer order). Additionally, it should be understood that the predetermined axis could be any predetermined axis on the display (e.g., a vertical axis from top to bottom, a horizontal axis from left to right, or a diagonal axis from the upper left corner to the lower right corner, etc.).
In some of these embodiments, when the component of movement of the second contact has a respective magnitude in the first direction (e.g., upwards), the position of the respective object within the second layer order is a respective number of positions higher than the position of the respective object within the first layer order; and when the vertical component of movement of the second contact has the same respective magnitude in the second direction (e.g., downwards), the position of the respective object within the second layer order is the same respective number of positions lower than the position of the respective object within the first layer order. In other words, in these embodiments, the correlation between the movement of the second contact on the touch-sensitive surface and the movement of an object within the layer order is determined such that movement by the same amount along the predetermined axis on the touch-sensitive surface in either direction results in moving the object by the same number of positions on the display. For example, if the second contact had a vertical component of movement of 2 centimeters in the upwards direction on the touch-sensitive surface, the selected object would be moved forward two positions in the layer order (e.g., from position "3" to position "1") on the display, in contrast, if the second contact had a vertical component of 2 centimeters in the downwards direction on the touch-sensitive surface, the selected object would be moved backwards two positions in the layer order (e.g., from position "3" to position "5") on the display.

In some embodiments, the position of the respective object in the second layer order is determined (636) in accordance with: a magnitude of the component of movement of the second contact that corresponds to the predetermined axis of the display; a distance between an initial location of the second contact on the touch-sensitive surface and an edge of the touch-sensitive surface; and a quantity of objects that are included in the plurality of objects. For example, in Figures 5B-5C, the predetermined axis of the display is parallel to the vertical edges of the display. In this example, a number of regions 5008 equal to the quantity of objects (e.g., there are six regions 5008, each corresponding to one of the six objects 5002) in the plurality of objects are distributed along the predetermined axis so that the initial location 5006-a of the contact corresponds to the region 5008-3 corresponding to the current position of the respective object 5002-3 in the first layer order. The size of these regions is determined in accordance with the distance between the initial location 5006-a of the contact and the top edge of the touch screen 112, so that there is room between the top edge of the touch screen 112 and the region 5008-3 associated with the contact for regions
(e.g., 5008-1 and 5008-2) associated with all of the layers in the first layer order that are above the current layer of the respective object 5002-3 and so that there is room between the bottom edge of the touch screen 112 and the region 5008-3 associated with the contact for regions (e.g., 5008-4, 5008-5, and 5008-6) associated with all of the layers in the first layer order that are below the current layer of the respective object 5002-3. Continuing with this example, when the second contact 5006 moves from the initial location 5006-a in Figure 5B of the contact on the touch sensitive surface to the updated location 5006-b in Figure 5C, the respective object 5002-3 moves forward by one position in the layer order. In contrast, in Figure 5D, when the second contact moves to the updated location 5006-c, the respective object 5002-3 moves two positions forward in the layer order (e.g., because the vertical distance between the initial location of the contact 5006-a and the updated location of the contact 5006-c in Figure 5D is approximately twice the vertical distance between the initial location of the contact 5006-a and the updated location of the contact 5006-b in Figure 5C).

[00154] In some embodiments, regions (e.g., 5008 in Figures 5B-5D and 5F-5J) in a space between a first edge (e.g., top) of the touch-sensitive surface (e.g., touch screen 112) and a second edge (e.g., bottom) of the touch-sensitive surface (e.g., touch screen 112) are mapped (638) to positions in the first layer order. For example in Figure 5B-5D a first region 5008-1 is mapped to a first position (e.g., position "1") in the first layer order; a second region 5008-2 is mapped to a second position (e.g., position "2") in the first layer order; a third region 5008-3 is mapped to a third position (e.g., position "3") in the first layer order; a fourth region 5008-4 is mapped to a fourth position (e.g., position "4") in the first layer order; a fifth region 5008-5 is mapped to a fifth position (e.g., position "5") in the first layer order; and a sixth region 5008-6 is mapped to a sixth position (e.g., position "6") in the first layer order. As another example, in Figure 5F-5J a first region 5008-1 is mapped to a first position (e.g., position "1") in the first layer order; a second region 5008-2 is mapped to a second position (e.g., position "2") in the first layer order; a third region 5008-3 is mapped to a third position (e.g., position "3") in the first layer order; a fourth region 5008-4 is mapped to a fourth position (e.g., position "4") in the first layer order; a fifth region 5008-5 is mapped to a fifth position (e.g., position "5") in the first layer order; and a sixth region 5008-6 is mapped to a sixth position (e.g., position "6") in the first layer order.

[00155] In these embodiments, the regions are mapped to the positions so that: the regions are arranged along a predefined axis of the touch-sensitive surface (e.g., touch screen 112) between the first edge (e.g., top) and the second edge (e.g., bottom) of the touch-
sensitive surface (e.g., touch screen 112) in accordance with the first layer order. For example, in Figures 5B-5D and 5F-5J, the regions 5008 are distributed vertically between the top of the touch screen 112 and the bottom of the touch screen 112 in accordance with the order of the positions to which they are mapped (e.g., the region 5008-1 that is mapped to the front position is closest to the top of the touch screen 112 and the region 5008-6 that is mapped to the back position is closest to the bottom of the touch screen 112).

[00156] In these embodiments, the regions are also mapped to the positions so that: an initial region that corresponds to the initial location of the second contact is mapped to a current position of the respective object. For example, in Figure 5B, the respective object 5002-3 is currently associated with the third position from the front when the second contact 5006 is detected on the touch screen 112, and thus the location of region 5008-3 that is mapped to third position from the front in Figures 5B-5D) is defined so as to include the initial location of the second contact 5006-a. As another example, in Figure 5F, the respective object 5002-5 is currently associated with the fifth position from the front when the second contact 5012 is detected on the touch screen 112, and thus the location of region 5008-5 that is mapped to fifth position from the front in Figures 5F-5J) is defined so as to include the initial location of the second contact 5012-a.

[00157] In these embodiments, the regions are mapped to the positions so that: each of the positions in front of the current position of the respective object is mapped to a region between the initial region and the first edge (e.g., above the initial region); and each of the positions behind the current position of the respective object is mapped to a region between the initial region and the second edge (e.g., below the initial region). For example, in Figures 5B-5D the regions (e.g., 5008-1 and 5008-2) above the initial region 5008-3 are mapped to the positions (e.g., the front position and the second position from the front, respectively) in front of the position (e.g., the third position from the front) of the respective object 5002-3, while the regions below (e.g., 5008-4, 5008-5, and 5008-6) the initial region 5008-3 are mapped to the positions (e.g., the fourth position from the front, the fifth position from the front, and the sixth position from the front, respectively) that are behind the position (e.g., the third position from the front) of the respective object 5002-3. As another example, in Figures 5F-5J, the regions above (e.g., 5008-1, 5008-2, 5008-3, and 5008-4) the initial region 5008-5 are mapped to the positions (e.g., the front position, the second position from the front, the third position from the front, and the fourth position from the front, respectively) in front of the position (e.g., the fifth position from the front) of the respective object 5002-5, while the
region below (e.g., 5008-6) the initial region 5008-5 is mapped to the position (e.g., the sixth position from the front) that is behind the position (e.g., the fifth position from the front) of the respective object 5002-5.

[00158] In these embodiments, the regions are mapped to the positions so that a size and location of each of the regions is determined in accordance with predefined criteria. For example, in Figures 5B-5D and Figures 5F-5J, the regions are of uniform size and are evenly spaced along the vertical axis of the touch screen 112. However, it should be understood that, in some embodiments, the regions are not of uniform size and/or are not spaced evenly along the vertical axis of the touch screen 112. For example, in some embodiments the regions may be sized and spaced in accordance with a logarithmic scale along a vertical axis of the touch-sensitive surface (e.g., when there are a large number of objects, and thus a large number of regions on the touch-sensitive surface (e.g., touch screen 112). Additionally, while the regions 5008 illustrated in Figures 5B-5D and Figures 5F-5J are shown as contiguous regions, it should be understood that the regions may, in fact be separated and reduced in size, so that they function as discrete locations on the touch-sensitive surface that correspond to positions in the first layer order.

[00159] It should be understood that, when determining the regions 5008 in accordance with the methods described above, when the number of objects, the distance between the contact and the edge of the touch-sensitive surface, and/or the position of the respective objects within the first layer order is different between two object re-ordering operations, then the regions 5008 will typically be arranged differently (e.g., have different sizes and different locations along the predefined axis) for the two different object re-ordering operations. For example, while the regions 5008 for the object re-ordering operation illustrated in Figures 5B-5D and the regions 5008 for the object re-ordering operation illustrated in Figures 5F-5G are determined using the same criteria, the regions in Figures 5B-5D are arranged differently from the regions 5008 in Figures 5F-5G because, in Figure 5B, the respective object 5002-3 that is selected by the user is third from the front of the first layer order, while, in Figure 5F, the respective object that is selected by the user is fifth from the front of the first layer order. Thus, in this example, in Figure 5B, only two regions (e.g., a region 5008-1 for the front layer and a region 5008-2 for the layer second from the front) need to be positioned along the predefined axis between the region 5008-3 associated with the contact and the top of the touch screen, and consequently the regions in Figure 5B can be larger than the regions in Figure 5F. In contrast, in Figure 5F, four regions (e.g., a region 5008-1 for the front layer, a
region 5008-2 for the layer second from the front, a region 5008-3 for the layer third from the front, and a region 5008-4 for the layer fourth from the front) need to be positioned along the predefined axis between the region 5008-5 associated with the contact and the top of the touch screen, and consequently the regions in Figure 5F are smaller than the regions in Figure 5B so that all four regions (e.g., 5008-1, 5008-2, 5008-3, and 5008-4) will fit in the space along the predefined axis.

[00160] In some of these embodiments (e.g., embodiments where the regions are defined as described above), the gesture includes (640) movement of the second contact on the touch-sensitive surface; and the position of the respective object within the second layer order is (642) a position that is mapped to the region that corresponds to an updated location of the second contact on the touch-sensitive surface. For example, in Figures 5B-5D, the second contact 5006 moves from an initial location 5006-a in Figure 5B that corresponds to a region 5008-3 that is mapped to the third position from the front (e.g., the current position of the respective object 5002-3), to an updated location 5006-c in Figure 5D that corresponds to a region 5008-1 that is mapped to the front position in the first layer order, and thus, the position of the respective object 5002-3 within the second layer order is the front position (e.g., the respective object 5002-3 is moved from the third position from the front to the front position), as illustrated in Figure 5D.

[00161] In accordance with some embodiments, Figure 7 shows a functional block diagram of an electronic device 700 configured in accordance with the principles of the invention as described above. The functional blocks of the device may be implemented by hardware, software, or a combination of hardware and software to carry out the principles of the invention. It is understood by persons of skill in the art that the functional blocks described in Figure 7 may be combined or separated into sub-blocks to implement the principles of the invention as described above. Therefore, the description herein may support any possible combination or separation or further definition of the functional blocks described herein.

[00162] As shown in Figure 7, an electronic device 700 includes a display unit 702 configured to display a plurality of objects, where the plurality of objects have a first layer order; a touch-sensitive surface unit 704 configured to receive contacts and gestures; and a processing unit 706 coupled to the display unit 702 and the touch-sensitive surface unit 704. In some embodiments, the processing unit 706 includes a detecting unit 708, a reordering unit 710, a display enabling unit 712, and an updating unit 714.
The processing unit 706 is configured to: detect a first contact at a location on the touch-sensitive surface unit 704 that corresponds to a location of a respective object on the display unit 702 (e.g., with the detecting unit 708); while detecting the first contact, detect a gesture that includes a second contact on the touch-sensitive surface unit 704 (e.g., with the detecting unit 708); and, in response to detecting the gesture, reorder the plurality of objects in accordance with the gesture to create a second layer order that is different from the first layer order (e.g., with the reordering unit 710).

In some embodiments, the position of the respective object within the first layer order is different from the position of the respective object within the second layer order.

In some embodiments, the gesture meets predetermined object-reordering criteria, the predetermined object reordering criteria including that: the second contact is maintained for more than a predetermined threshold amount of time at a location on the touch-sensitive surface unit 704 that corresponds to a portion of the display unit 702 that is apart from any objects in the plurality of objects; and, after the second contact is maintained for more than the predetermined threshold amount of time, movement of the second contact is detected on the touch-sensitive surface unit 704 that is above a threshold amount of movement.

In some embodiments, the processing unit 706 is configured to enable display of, for each respective object in at least a subset of the plurality of objects, a respective object order indicator, where the respective object order indicator for a respective object provides a visual indication of a position of the respective object within the first layer order (e.g., with the display enabling unit 712).

In some embodiments, the object order indicators are displayed in response to detecting an input that meets object order indicator display criteria.

In some embodiments, the processing unit 706 is configured to, in response to detecting the gesture, update the respective object order indicator for the respective object, so that the respective object order indicator provides a visual indication of a position of the respective object within the second layer order (e.g., with the updating unit 714).

In some embodiments, multiple objects, including the respective object, are selected objects when the gesture is detected, and a position of each of the selected objects
within the first layer order is different from a position of each of the selected objects within
the second layer order.

[00170] In some embodiments, in the first layer order, each of the selected objects has
a relative position with respect to the other selected objects, and in the second layer order,
each of the selected objects has the same relative position with respect to the other selected
objects.

[00171] In some embodiments, in the first layer order, an object in the plurality of
objects that is not selected has a position that is between two of the selected objects, and in
the second layer order, the two selected objects are consecutively ordered.

[00172] In some embodiments, the gesture includes movement of the second contact
on the touch-sensitive surface unit 704, and the second layer order is determined in
accordance with a component of the movement of the second contact that corresponds to a
predetermined axis of the display unit 702.

[00173] In some embodiments, when the component of movement of the second
contact that corresponds to the predetermined axis of the display unit 702 is in a first
direction, a position of the respective object in the second layer order is higher than a position
of the respective object in the first layer order, and when the component of movement of the
second contact that corresponds to the predetermined axis of the display unit 702 is in a
second direction that is opposite to the first direction, a position of the respective object in the
second layer order is lower than the position of the respective object in the first layer order.

[00174] In some embodiments, when the component of movement of the second
contact has a respective magnitude in the first direction, the position of the respective object
within the second layer order is a respective number of positions higher than the position of
the respective object within the first layer order, and when the vertical component of
movement of the second contact has the same respective magnitude in the second direction,
the position of the respective object within the second layer order is the same respective
number of positions lower than the position of the respective object within the first layer
order.

[00175] In some embodiments, the position of the respective object in the second layer
order is determined in accordance with: a magnitude of the component of movement of the
second contact that corresponds to the predetermined axis of the display unit 702, a distance
between an initial location of the second contact on the touch-sensitive surface unit 704 and
an edge of the touch-sensitive surface unit 704, and a quantity of objects that are included in
the plurality of objects.

[00176] In some embodiments, regions in a space between a first edge of the touch-
sensitive surface unit 704 and a second edge of the touch-sensitive surface unit 704 are
mapped to positions in the first layer order so that: the regions are arranged along a
predefined axis of the touch-sensitive surface unit 704 between the first edge of the touch-
sensitive surface unit 704 and the second edge of the touch-sensitive surface unit 704 in
accordance with the first layer order; an initial region that corresponds to the initial location
of the second contact is mapped to a current position of the respective object; each of the
positions above the current position of the respective object is mapped to a region between
the initial region and the first edge; each of the positions below the current position of the
respective object is mapped to a region between the initial region and the second edge; and a
size and location of each of the regions is determined in accordance with predefined criteria.
The gesture includes movement of the second contact on the touch-sensitive surface unit 704.
The position of the respective object within the second layer order is a position that is
mapped to the region that corresponds to an updated location of the second contact on the
touch-sensitive surface unit 704.

[00177] The operations in the information processing methods described above may be
implemented by running one or more functional modules in information processing apparatus
such as general purpose processors or application specific chips. These modules,
combinations of these modules, and/or their combination with general hardware (e.g., as
described above with respect to Figures 1A, 1B, 3, and 7) are all included within the scope of
protection of the invention.

[00178] The operations described above with reference to Figures 6A-6D may be
implemented by components depicted in Figures 1A-1C. For example, displaying operation
602, detecting operation 610, and detecting operation 614 may be implemented by event
sorter 170, event recognizer 180, and event handler 190. Event monitor 171 in event sorter
170 detects a contact on touch-sensitive display 112, and event dispatcher module 174
delivers the event information to application 136-1. A respective event recognizer 180 of
application 136-1 compares the event information to respective event definitions 186, and
determines whether a first contact at a first location on the touch-sensitive surface
corresponds to a predefined event or sub-event, such as selection of an object on a user
interface. When a respective predefined event or sub-event is detected, event recognizer 180
activates an event handler 190 associated with the detection of the event or sub-event. Event handler 190 may utilize or call data updater 176 or object updater 177 to update the application internal state 192. In some embodiments, event handler 190 accesses a respective GUI updater 178 to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in Figures 1A-1C.

[00179] The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated.
What is claimed is:

1. A method, comprising:
   at a multifunction device with a touch-sensitive surface and a display:
      displaying a plurality of objects on the display, wherein the plurality of objects has a
      first layer order;
      detecting a first contact at a location on the touch-sensitive surface that corresponds to
      a location of a respective object on the display;
      while detecting the first contact, detecting a gesture that includes a second contact on
      the touch-sensitive surface; and,
      in response to detecting the gesture, reordering the plurality of objects in accordance
      with the gesture to create a second layer order that is different from the first layer order.

2. The method of claim 1, wherein the position of the respective object within the first
   layer order is different from the position of the respective object within the second layer
   order.

3. The method of any of claims 1-2, wherein the gesture meets predetermined object-
   reordering criteria, the predetermined object reordering criteria including that:
      the second contact is maintained for more than a predetermined threshold amount of
      time at a location on the touch-sensitive surface that corresponds to a portion of the display
      that is apart from any objects in the plurality of objects; and,
      after the second contact is maintained for more than the predetermined threshold
      amount of time, movement of the second contact is detected on the touch-sensitive surface
      that is above a threshold amount of movement.

4. The method of any of claims 1-3, including displaying, for each respective object in at
   least a subset of the plurality of objects, a respective object order indicator, wherein the
   respective object order indicator for a respective object provides a visual indication of a
   position of the respective object within the first layer order.

5. The method of claim 4, wherein the object order indicators are displayed in response
   to detecting an input that meets object order indicator display criteria.

6. The method of any of claims 4-5, including, in response to detecting the gesture,
   updating the respective object order indicator for the respective object, so that the respective
object order indicator provides a visual indication of a position of the respective object within the second layer order.

7. The method of any of claims 1-6, wherein multiple objects, including the respective object, are selected objects when the gesture is detected, and a position of each of the selected objects within the first layer order is different from a position of each of the selected objects within the second layer order.

8. The method of claim 7, wherein:
   in the first layer order, each of the selected objects has a relative position with respect to the other selected objects; and
   in the second layer order, each of the selected objects has the same relative position with respect to the other selected objects.

9. The method of any of claims 7-8, wherein:
   in the first layer order, an object in the plurality of objects that is not selected has a position that is between two of the selected objects; and
   in the second layer order, the two selected objects are consecutively ordered.

10. The method of any of claims 1-9, wherein:
    the gesture includes movement of the second contact on the touch-sensitive surface; and
    the second layer order is determined in accordance with a component of the movement of the second contact that corresponds to a predetermined axis of the display.

11. The method of claim 10, wherein:
    when the component of movement of the second contact that corresponds to the predetermined axis of the display is in a first direction, a position of the respective object in the second layer order is higher than a position of the respective object in the first layer order; and,
    when the component of movement of the second contact that corresponds to the predetermined axis of the display is in a second direction that is opposite to the first direction, a position of the respective object in the second layer order is lower than the position of the respective object in the first layer order.

12. The method of claim 11, wherein:
when the component of movement of the second contact has a respective magnitude in the first direction, the position of the respective object within the second layer order is a respective number of positions higher than the position of the respective object within the first layer order; and,

when the vertical component of movement of the second contact has the same respective magnitude in the second direction, the position of the respective object within the second layer order is the same respective number of positions lower than the position of the respective object within the first layer order.

13. The method of any of claims 10-12, wherein the position of the respective object in the second layer order is determined in accordance with:

a magnitude of the component of movement of the second contact that corresponds to the predetermined axis of the display;

a distance between an initial location of the second contact on the touch-sensitive surface and an edge of the touch-sensitive surface; and

a quantity of objects that are included in the plurality of objects.

14. The method of any of claims 1-13, wherein:

regions in a space between a first edge of the touch-sensitive surface and a second edge of the touch-sensitive surface are mapped to positions in the first layer order so that:

the regions are arranged along a predefined axis of the touch-sensitive surface between the first edge of the touch-sensitive surface and the second edge of the touch-sensitive surface in accordance with the first layer order;

an initial region that corresponds to the initial location of the second contact is mapped to a current position of the respective object;

each of the positions above the current position of the respective object is mapped to a region between the initial region and the first edge;

each of the positions below the current position of the respective object is mapped to a region between the initial region and the second edge; and

a size and location of each of the regions is determined in accordance with predefined criteria;

the gesture includes movement of the second contact on the touch-sensitive surface; and
the position of the respective object within the second layer order is a position that is mapped to the region that corresponds to an updated location of the second contact on the touch-sensitive surface.

15. A multifunction device, comprising:
   a display;
   a touch-sensitive surface;
   one or more processors;
   memory; and
   one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:
   - displaying a plurality of objects on the display, wherein the plurality of objects has a first layer order;
   - detecting a first contact at a location on the touch-sensitive surface that corresponds to a location of a respective object on the display;
   - while detecting the first contact, detecting a gesture that includes a second contact on the touch-sensitive surface; and,
   - in response to detecting the gesture, reordering the plurality of objects in accordance with the gesture to create a second layer order that is different from the first layer order.

16. The device of claim 15, wherein the position of the respective object within the first layer order is different from the position of the respective object within the second layer order.

17. The device of any of claims 15-16, including instructions for displaying, for each respective object in at least a subset of the plurality of objects, a respective object order indicator, wherein the respective object order indicator for a respective object provides a visual indication of a position of the respective object within the first layer order.

18. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by a multifunction device with a display and a touch-sensitive surface, cause the device to:
   - display a plurality of objects on the display, wherein the plurality of objects has a first layer order;
detect a first contact at a location on the touch-sensitive surface that corresponds to a
location of a respective object on the display;

while detecting the first contact, detect a gesture that includes a second contact on the
touch-sensitive surface; and,

in response to detecting the gesture, reorder the plurality of objects in accordance with
the gesture so as to create a second layer order that is different from the first layer order.

19. The computer readable storage medium of claim 18, wherein the position of the respective object within the first layer order is different from the position of the respective object within the second layer order.

20. A graphical user interface on a multifunction device with a display, a touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising:

a plurality of objects;

wherein:

the plurality of objects has a first layer order;

a first contact is detected at a location on the touch-sensitive surface that corresponds to a location of a respective object on the display;

while detecting the first contact, a gesture that includes a second contact is detected on the touch-sensitive surface; and,

in response to detecting the gesture, the plurality of objects is reordered in accordance with the gesture to create a second layer order that is different from the first layer order.

21. An electronic device, comprising:

a display unit configured to display a plurality of objects, wherein the plurality of objects has a first layer order;

a touch-sensitive surface unit configured to receive contacts and gestures; and

a processing unit coupled to the display unit and the touch-sensitive surface unit, the processing unit configured to:

detect a first contact at a location on the touch-sensitive surface unit that corresponds to a location of a respective object on the display;

while detecting the first contact, detect a gesture that includes a second contact on the touch-sensitive surface unit; and,
in response to detecting the gesture, reorder the plurality of objects in accordance with the gesture to create a second layer order that is different from the first layer order.

22. The device of claim 21, wherein the position of the respective object within the first layer order is different from the position of the respective object within the second layer order.

23. The device of any of claims 21-22, wherein the gesture meets predetermined object-reordering criteria, the predetermined object reordering criteria including that:
   - the second contact is maintained for more than a predetermined threshold amount of time at a location on the touch-sensitive surface unit that corresponds to a portion of the display unit that is apart from any objects in the plurality of objects; and,
   - after the second contact is maintained for more than the predetermined threshold amount of time, movement of the second contact is detected on the touch-sensitive surface unit that is above a threshold amount of movement.

24. The device of any of claims 21-23, wherein the processing unit is configured to enable display of, for each respective object in at least a subset of the plurality of objects, a respective object order indicator, wherein the respective object order indicator for a respective object provides a visual indication of a position of the respective object within the first layer order.

25. The device of claim 24, wherein the object order indicators are displayed in response to detecting an input that meets object order indicator display criteria.

26. The device of any of claims 24-25, wherein the processing unit is configured to, in response to detecting the gesture, update the respective object order indicator for the respective object, so that the respective object order indicator provides a visual indication of a position of the respective object within the second layer order.

27. The device of any of claims 21-26, wherein multiple objects, including the respective object, are selected objects when the gesture is detected, and a position of each of the selected objects within the first layer order is different from a position of each of the selected objects within the second layer order.

28. The device of claim 27, wherein:
in the first layer order, each of the selected objects has a relative position with respect to the other selected objects; and
in the second layer order, each of the selected objects has the same relative position with respect to the other selected objects.

29. The device of any of claims 27-28, wherein:
in the first layer order, an object in the plurality of objects that is not selected has a position that is between two of the selected objects; and
in the second layer order, the two selected objects are consecutively ordered.

30. The device of any of claims 21-29, wherein:
the gesture includes movement of the second contact on the touch-sensitive surface unit; and
the second layer order is determined in accordance with a component of the movement of the second contact that corresponds to a predetermined axis of the display unit.

31. The device of claim 30, wherein:
when the component of movement of the second contact that corresponds to the predetermined axis of the display unit is in a first direction, a position of the respective object in the second layer order is higher than a position of the respective object in the first layer order; and,
when the component of movement of the second contact that corresponds to the predetermined axis of the display unit is in a second direction that is opposite to the first direction, a position of the respective object in the second layer order is lower than the position of the respective object in the first layer order.

32. The device of claim 31, wherein:
when the component of movement of the second contact has a respective magnitude in the first direction, the position of the respective object within the second layer order is a respective number of positions higher than the position of the respective object within the first layer order; and,
when the vertical component of movement of the second contact has the same respective magnitude in the second direction, the position of the respective object within the second layer order is the same respective number of positions lower than the position of the respective object within the first layer order.
33. The device of any of claims 30-32, wherein the position of the respective object in the second layer order is determined in accordance with:
   a magnitude of the component of movement of the second contact that corresponds to the predetermined axis of the display unit;
   a distance between an initial location of the second contact on the touch-sensitive surface unit and an edge of the touch-sensitive surface unit; and
   a quantity of objects that are included in the plurality of objects.

34. The device of any of claims 21-33, wherein:
   regions in a space between a first edge of the touch-sensitive surface unit and a second edge of the touch-sensitive surface unit are mapped to positions in the first layer order so that:
   the regions are arranged along a predefined axis of the touch-sensitive surface unit between the first edge of the touch-sensitive surface unit and the second edge of the touch-sensitive surface unit in accordance with the first layer order;
   an initial region that corresponds to the initial location of the second contact is mapped to a current position of the respective object;
   each of the positions above the current position of the respective object is mapped to a region between the initial region and the first edge;
   each of the positions below the current position of the respective object is mapped to a region between the initial region and the second edge; and
   a size and location of each of the regions is determined in accordance with predefined criteria;
   the gesture includes movement of the second contact on the touch-sensitive surface unit; and
   the position of the respective object within the second layer order is a position that is mapped to the region that corresponds to an updated location of the second contact on the touch-sensitive surface unit.

35. A multifunction device, comprising:
   a display;
   a touch-sensitive surface; 
   one or more processors;
   memory; and
one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for performing any of the methods of claims 1-14.

36. A computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by a multifunction device with a display and a touch-sensitive surface, cause the device to perform any of the methods of claims 1-14.

37. A graphical user interface on a multifunction device with a display, a touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory, the graphical user interface comprising user interfaces displayed in accordance with any of the methods of claims 1-14.
Portable Multifunction Device 100

Speaker 111
Optical Sensor 164
Proximity Sensor 166

210 is SIM card slot
212 is headphone jack

Touch Screen 112

Microphone 113
Home 204
Accelerometer(s) 168

External Port 124

Figure 2
Display a plurality of objects. The plurality of objects has a first layer order.

Detect an input that meets object order indicator display criteria

Display, for each respective object in at least a subset of the plurality of objects, a respective object order indicator. The respective object order indicator for a respective object provides a visual indication of a position of the respective object within the first layer order.

The object order indicators are displayed in response to detecting the input that meets object order indicator display criteria

Detect a first contact at a location on the touch-sensitive surface that corresponds to a location of a respective object on the display

Select multiple objects, including the respective object

While detecting the first contact, detect a gesture that includes a second contact on the touch-sensitive surface

The gesture meets predetermined object-reordering criteria, the predetermined object reordering criteria including that:

the second contact is maintained for more than a predetermined threshold amount of time at a location on the touch-sensitive surface that corresponds to a portion of the display that is apart from any objects in the plurality of objects; and,

after the second contact is maintained for more than the predetermined threshold amount of time, movement of the second contact is detected on the touch-sensitive surface that is above a threshold amount of movement.
In response to detecting the gesture, reorder the plurality of objects in accordance with the gesture to create a second layer order that is different from the first layer order.

The position of the respective object within the first layer order is different from the position of the respective object within the second layer order.

Multiple objects, including the respective object, are selected objects when the gesture is detected. A position of each of the selected objects within the first layer order is different from a position of each of the selected objects within the second layer order.

In the first layer order, each of the selected objects has a relative position with respect to the other selected objects.

In the second layer order, each of the selected objects has the same relative position with respect to the other selected objects.

In the first layer order, an object in the plurality of objects that is not selected has a position that is between two of the selected objects.

In the second layer order, the two selected objects are consecutively ordered.

When an object order indicator that provides a visual indication of a position of the respective object within the first layer order is displayed for each respective object in at least a subset of the plurality of objects: in response to detecting the gesture, update the respective object order indicator for the respective object, so that the respective object order indicator provides a visual indication of a position of the respective object within the second layer order.
In response to detecting the gesture, reorder the plurality of objects in accordance with the gesture to create a second layer order that is different from the first layer order.

The gesture includes movement of the second contact on the touch-sensitive surface; and the second layer order is determined in accordance with a component of the movement of the second contact that corresponds to a predetermined axis of the display.

When the component of movement of the second contact that corresponds to the predetermined axis of the display is in a first direction, a position of the respective object in the second layer order is higher than a position of the respective object in the first layer order.

When the component of movement of the second contact that corresponds to the predetermined axis of the display is in a second direction that is opposite to the first direction, a position of the respective object in the second layer order is lower than the position of the respective object in the first layer order.

When the component of movement of the second contact has a respective magnitude in the first direction, the position of the respective object within the second layer order is a respective number of positions higher than the position of the respective object within the first layer order.

When the vertical component of movement of the second contact has the same respective magnitude in the second direction, the position of the respective object within the second layer order is the same respective number of positions lower than the position of the respective object within the first layer order.

The position of the respective object in the second layer order is determined in accordance with: a magnitude of the component of movement of the second contact that corresponds to the predetermined axis of the display; a distance between an initial location of the second contact on the touch-sensitive surface and an edge of the touch-sensitive surface; and a quantity of objects that are included in the plurality of objects.
In response to detecting the gesture, reorder the plurality of objects in accordance with the gesture to create a second layer order that is different from the first layer order.

Regions in a space between a first edge of the touch-sensitive surface and a second edge of the touch-sensitive surface are mapped to positions in the first layer order so that: the regions are arranged along a predefined axis of the touch-sensitive surface between the first edge of the touch-sensitive surface to the second edge of the touch-sensitive surface in accordance with the first layer order; an initial region that corresponds to the initial location of the second contact is mapped to a current position of the respective object; each of the positions above the current position of the respective object is mapped to a region between the initial region and the first edge; each of the positions below the current position of the respective object is mapped to a region between the initial region and the second edge; and a size and location of each of the regions is determined in accordance with predefined criteria.

The gesture includes movement of the second contact on the touch-sensitive surface

The position of the respective object within the second order is a position that is mapped to the region that corresponds to an updated location of the second contact on the touch-sensitive surface.
Figure 7

- Display unit 702
- Touch-sensitive surface unit 704
- Processing unit 706
  - Detecting unit 708
  - Re-ordering unit 710
  - Display enabling unit 712
  - Updating unit 714
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F3/048
ADD.

According to International Patent Classification (IPC) into both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
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<td>page 2, paragraph 0028 - paragraph 0030; figures 1, 4, 12</td>
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<td>column 8, line 43 - line 67; figures 6A-6C</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"*" document member of the same patent family

Date of the actual completion of the international search
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Date of mailing of the international search report
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Authorized officer
Kirsten, Karl

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page 3, paragraph 0052 - page 4, paragraph 0054; figure 4 | 1-37                 |
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