keynote

DeviceAnywhere Enterprise

How to Get the Best Results with Text Matching

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May 2011.

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Test Center Enterprise 5.2 SP4

Test Center Enterprise Automation 5.2.3

Test Center Enterprise Monitoring 5.2.3

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About This Document

This document describes how to achieve repeatable and reliable results with text-based reference points in automated scripts in Keynote DeviceAnywhere mobile test environments. Specifically, this document provides guidelines for:

- Device settings and script choices to optimize text recognition
- Choosing the correct method of text transformation based on device screen characteristics
- Choosing a string of reference text

With Test Center Enterprise products, you can create and run automated scripts to test or monitor your mobile device, application, or service. As part of your test script, you can implement *reference points* to verify the result of a sequence of device interactions.

A *text-based reference point* uses a string of text from the device screen as an expected result against which the outcome of a script can be verified. For instance, if your script navigates to the device idle screen, you can define a string of text that appears on the idle screen as a text-based expected result. At runtime, Keynote DeviceAnywhere uses optical character recognition (OCR) technology to match the actual device screen to the reference string for script verification.

Document Outline

This document assumes that you are familiar with the mechanics of creating text-based reference points in individual commands as well as in states—please refer to the TCE Automation User Guide for detailed, step-by-step instructions on setting reference points.

This document builds on the information contained in the *User Guide* to discuss:

- A high-level overview of when to use text-based reference points
- Guidelines for device settings and script choices to optimize text recognition
- Guidelines for choosing and implementing a text transformation method
- Guidelines for selecting a string of reference text

The purpose of these guidelines is to help improve your match ratio, reliably generating the matches you want and eliminating the matches you do not want, minimizing both mismatches and false positives.

Typographical Conventions

The table below describes the typographical conventions used in Keynote DeviceAnywhere documentation.

Style	Element	Examples
Blue	Links and email addresses	http://www.keynotedeviceanywhere.com The Document Outline section on this page describes the structure of this manual.
Bold	User interface elements such as menu items	Click **My Devices** in the **Test Center** view of Keynote DeviceAnywhere Studio.

Style	Element	Examples
`Monospace`	Commands, code output, filenames, directories	Right-click the project's `step groups` directory.
`Monospace bold`	User input	In a command window, type **`adb kill-server`**.
Italic	Document titles and emphasis	Refer to the *Keynote DeviceAnywhere Private System Installation Guide* for instructions on setting up server infrastructure.

Contacting Support

If you have any comments or suggestions regarding this document, contact the Keynote DeviceAnywhere support organization for enterprise customers at kda-esupport@deviceanywhere.com. You may also send your inquiries about Keynote DeviceAnywhere product demonstrations and consulting services to this address.

Customers can find additional support information at http://www.keynotedeviceanywhere.com/enterprise-support.html.

Additional Documentation

You can find additional information in the following documents (available at http://www.keynotedeviceanywhere.com/tce-documentation.html):

- *TCE Automation User Guide*
- *TCE Automation Guide to Image Matching*

You can also access documentation from the **Help** menu in Keynote DeviceAnywhere Studio.

1 Introduction

Reference points are device conditions, screens, or output used to verify a sequence of device interactions, e.g., an application home page, login confirmation, or incoming SMS message confirmation.

Reference points can be text-, image-, or audio-based.

- *Image-based reference points* define an area of the device screen to be used for script verification.
- *Text-based reference points* use a text string from a device screen for script verification.
- *Audio-based reference points* call for your script to detect any device audio (or a specific DTMF sequence) for verification.

1.1 When to Use Reference Points

Reference points are necessary and useful for:

- Validating success or failure of your script
- Verifying that your device is in the correct state
- Verifying that a certain device event (input or output) has occurred

Periodic insertion of reference points in your script is a good practice as it verifies that a device is in the correct state for the execution of subsequent commands.

It is advisable to use reference points:

- At periodic intervals in your script, e.g., in each branch, to verify that a device is in the correct state for the execution of subsequent commands
- To verify the overall success/failure of your script or branch, i.e., verify that the correct screen was displayed
- When dynamic wait times as when loading an application or Web site require screen confirmation before proceeding
- When slow device response is slow due to network latency, requiring screen confirmation before continuing with a script

Reference points are also useful because you can trigger error messaging in the **Timeout** tab of commands that define reference points. The errors triggered (and their custom annotations) are included in test results for more complete reporting.

1.1.1 When to Use Text-Based Reference Points

Use the following guidelines when choosing which UI-based (i.e., text or image) reference point to implement:

1. Whenever possible, use a text-based reference point first before making the decision to use an image-based reference point.

   Image-based reference points use image matching technology to match the actual device screen pixel-by-pixel to the reference image, while text-based reference points use optical character recognition (OCR) technology to match the reference string to the actual device screen. As OCR technology can match a string of text even with changes in font face and size, text matching can often be more robust than image matching.

2 Use an image-based reference point when text matching is not feasible, as in the following cases:

- There is not enough contrast between the text and its background for text to be correctly extracted (recognized) from the device screen.
- Text on the screen is subject to change (e.g., time or date information), leading to failed matches.
- Text on the screen does not uniquely identify the screen, generating the possibility of false positives.
- There is no text on the screen.

1.2 Where You Can Implement Text-Based Reference Points

You can create *device-specific* reference points in certain scripting commands or *device independent* reference points in *states*.

You can create script- or device-specific reference points in the following commands:

- Wait Text
- Wait Event
- Navigate To

Device- or script-specific reference points are called so because they cannot be reused across other scripts.

NOTES You can also specify a text string for your script to touch (e.g., hyperlinked text) in the Find Text and Touch command. While the text string selected does not act as a reference point, the guidelines in this document for selecting and transforming text apply to this command as well.

You can store an extracted text string in a variable in the Extract Text command. In this case too, the extracted text string does not serve as a reference point; it is used instead to populate a variable for use later in the same script or another project script. Guidelines in this document for selecting and transforming text apply to the Extract Text command as well.

You can create a device-independent reference point in a *state* that is defined for all project devices. States consist of device-specific implementations to account for differences in interfaces. Once you have created a state, use the Wait State command to call a state in an action or test case. You can also simply drag a state into your action/test case script from the project directory.

The mechanism for defining reference text in device-specific commands or device-independent states is the same.

Refer to the *TCE Automation User Guide* for detailed explanations of how to define text-, image-, and audio-based reference points.

2 General Guidelines for Implementing Text Matching

This chapter presents general guidelines for using text-based reference points.

2.1 Optimal Device Settings

Follow these device setup guidelines as you prepare for automation scripting with text-based reference points, regardless of the string of text chosen.

These guidelines are aimed at:

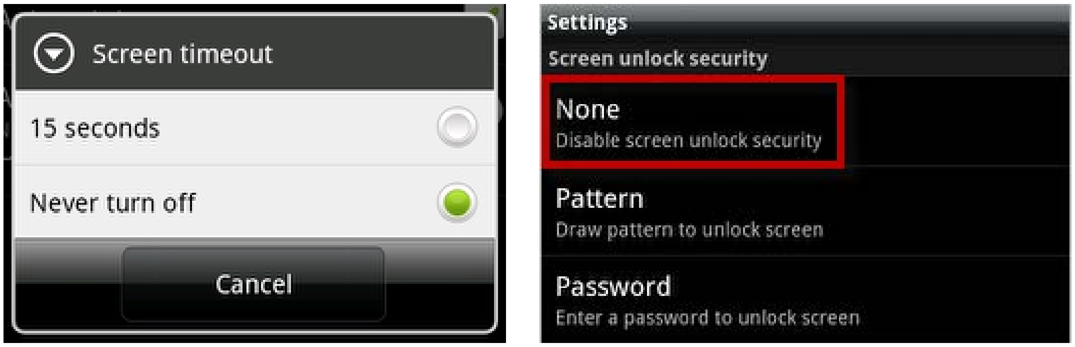
- Keeping your device as far as possible in a consistent state, avoiding changes to the theme or settings, firmware upgrades, and other changes that can interfere with script execution (including reference images)
- Minimizing unnecessary script steps and ensuring smooth and reliable script execution

Device Settings

Disable any device controls that automatically change the device screen as they can invalidate saved reference text or cause your script to fail.

- Screen timeout—turn off the backlight timer control or set it to the highest possible time so that the screen stays lit and your script can be executed as written.
- Screen lock and passwords—if possible, disable or extend the maximum time available for screen timeout so that your script can be executed as written. . Disable passwords and lock patterns so you do not have to script around them.

Figure 2-1 Screen Timeout and Lock Settings in Android



Screen timeout

15 seconds ○

Never turn off ●

Cancel

Settings

Screen unlock security

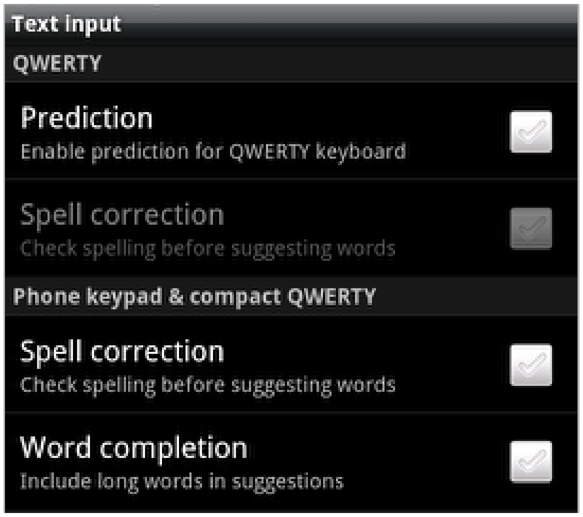
None
Disable screen unlock security

Pattern
Draw pattern to unlock screen

Password
Enter a password to unlock screen

- Autocorrection, word completion, predictive text, auto capitalization—disable these or any other features that automatically change text you are trying to enter.
- International keyboards—except for the language in which you are entering and matching text, turn off keyboards in all other languages. Do not change the default keyboard. Our key mapping expects to find the keyboard in a default state and assumes fixed locations for keys. But if you change the keyboard, some keys can change locations, or be completely replaced by some other key.

Figure 2-2 Text Input Settings in Android



Text input

QWERTY

Prediction ☑
Enable prediction for QWERTY keyboard

Spell correction ☑
Check spelling before suggesting words

Phone keypad & compact QWERTY

Spell correction ☑
Check spelling before suggesting words

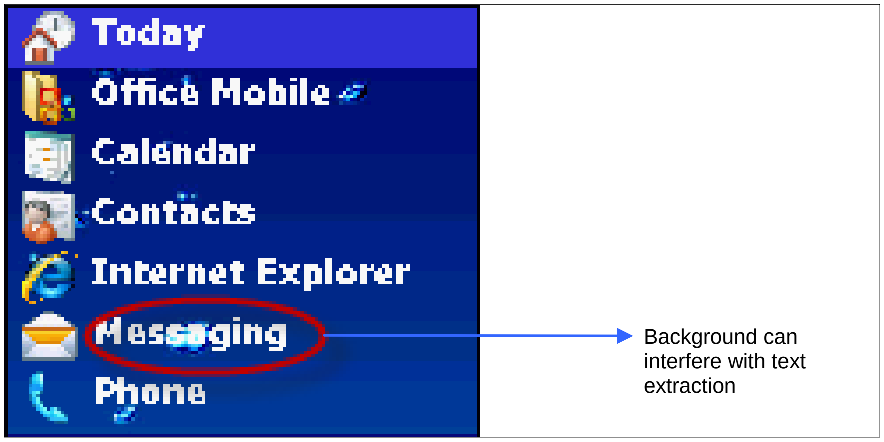
Word completion ☑
Include long words in suggestions

Device Wallpaper or Theme

Choose a device theme or wallpaper with minimum animation and color/font changes as these can interfere with text displayed and cause match failures. Wherever possible, choose a static, solid background.

If choosing a textured background, choose one with images that cannot be mistaken for text by the extraction engine. The image below shows an example of background elements that can interfere with text display and recognition.

Figure 2-3 Background Image Can Interfere with Text Extraction

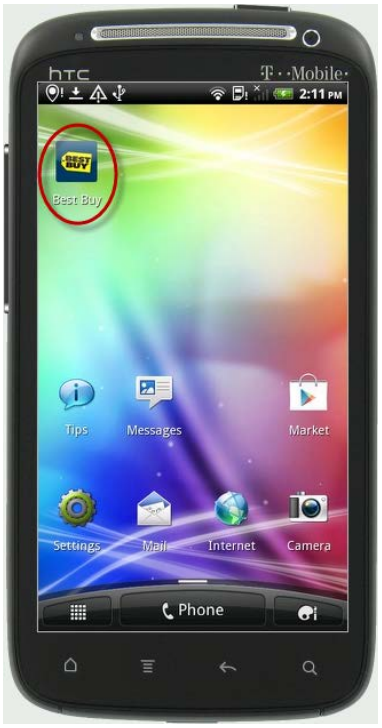


Background can interfere with text extraction

Application Setup

Move your application icon to the top of the home screen or application tray so you do not have to create additional script steps to find and launch it. Do not make changes to the default layout and appearance of the application so you can test its usability and functionality as designed.

Figure 2-4 Move Application Icon to Home Screen for Easy Launch



Reflash, Reset, or SIM Card Change

After setting up devices for automation scripting, avoid reflashing/resetting a device or changing a SIM card during the course of your testing.

Reflashing a device, or upgrading the operating system, can often result in changes to the device UI in terms of menus and applications. Be sure to check whether the OS upgrade has impacted any stored reference text by running the command in question. Recapture reference text if you need to.

Resetting a device (factory reset) almost certainly results in changes in audio and video settings such as theme or default options. This can impact stored reference text, e.g., reference text defined in terms of background color might need to be redefined (Guidelines for Transforming Text).

Additionally, applications, including the Keynote DeviceAnywhere Agent, are erased. You will need to reinstall the Agent on software-integrated devices for communicating with the Ensemble Server.

You might need to *change a SIM card* on your GSM device either because you have moved to a different carrier or have switched plans on the same carrier. Although your device UI should not change, certain menu options and applications might not be available to you. Also, there might be changes in carrier name, location, and date information as well as display language. Be sure to check whether changing a SIM card has impacted any stored reference text by running the command in question. Recapture reference text if you need to.

NOTE Rebooting or power cycling a device does not impact any stored reference text.

2.2 Script and Command Guidelines

This section discusses some test script choices/practices that can facilitate or otherwise impact text recognition.

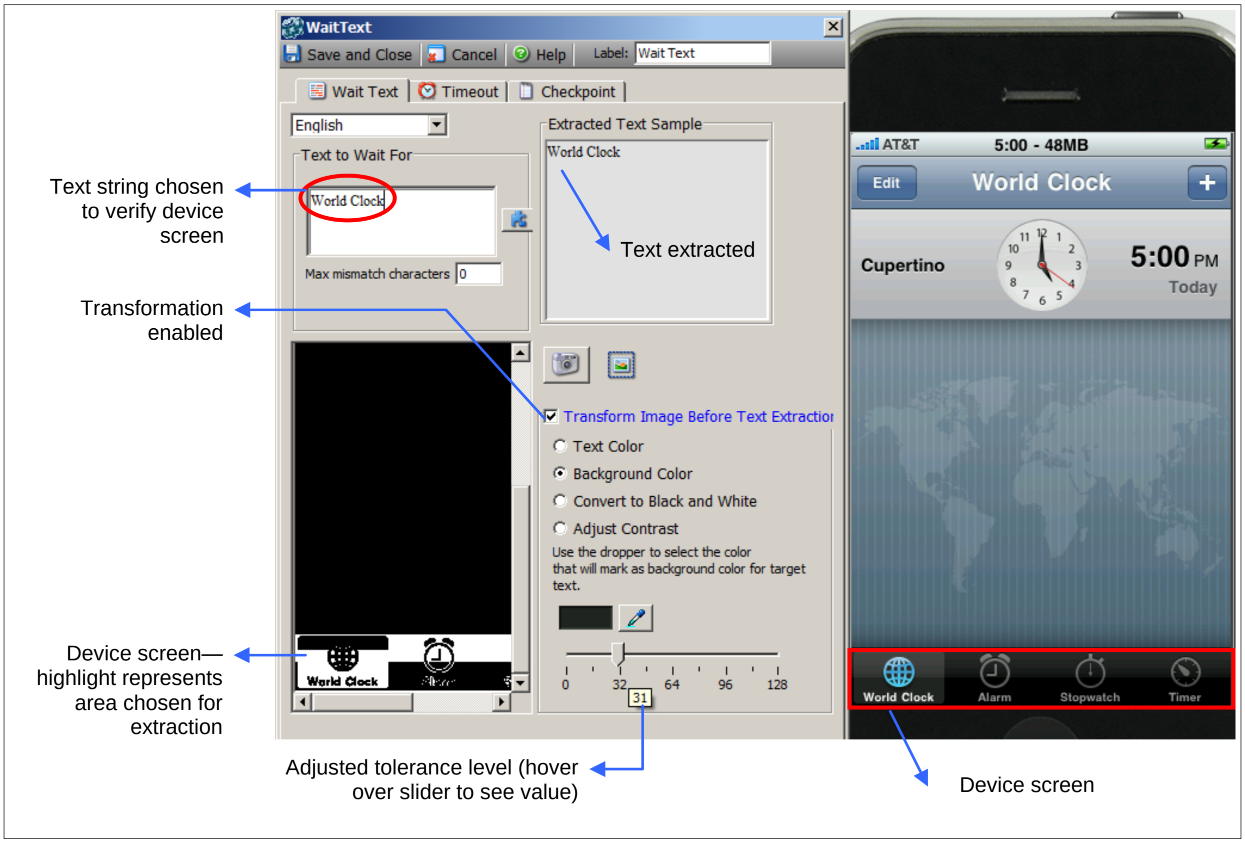
Text Transformation and Default Levels for Tolerance Sliders

When implementing a text-based reference point in a command or a state, we recommend that you always transform the device screen captured. Text transformation facilitates text recognition by rendering device text black on a white background (or vice versa, if not possible). Refer to the chapter Guidelines for Transforming Text for a detailed discussion of selecting an appropriate text transformation method based on characteristics of the device screen you wish to verify.

The tolerance sliders for each transformation method build in a margin of error in case the device screen changes slightly. Guidelines for Transforming Text provides specific instructions on using the tolerance slider for each transformation type: In general, however:

- Adjust tolerance sliders in small increments (e.g., up to the next notch on the scale).
- Adjust the sliders to the extent required to reliably extract the text you want.
- The tolerance sliders for transforming text by selecting text color or background color are set by default to a value of 10—do not decrease this value.

Figure 2-5 Using Text Transformation Controls (Wait Text)



Label: Wait Text

English

Text to Wait For: World Clock

Max mismatch characters 0

Extracted Text Sample: World Clock

☑ Transform Image Before Text Extraction

○ Text Color

● Background Color

○ Convert to Black and White

○ Adjust Contrast

Use the dropper to select the color that will mark as background color for target text.

Text string chosen to verify device screen

Transformation enabled

Device screen—highlight represents area chosen for extraction

Text extracted

Adjusted tolerance level (hover over slider to see value)

Device screen

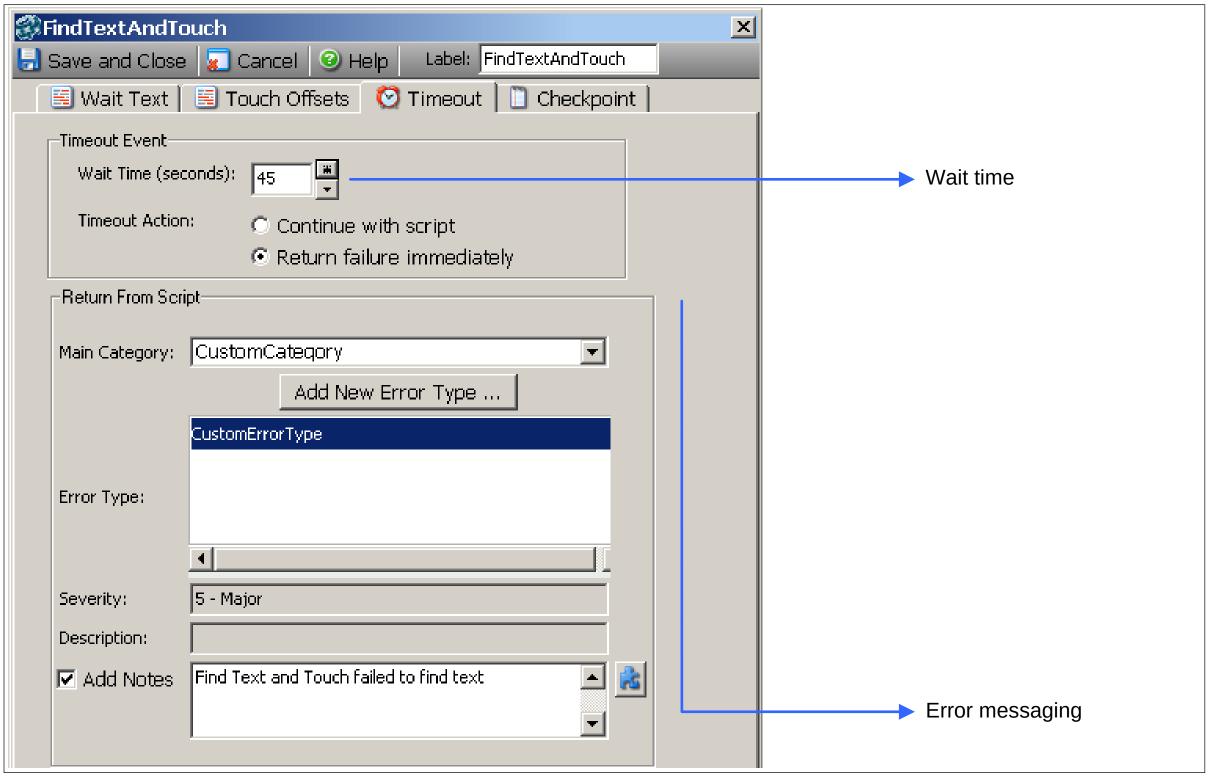
Wait Time

Provide sufficient wait time for preceding keystrokes to be performed and reference text to be matched. A Wait command set to 2 seconds can easily be inserted after a Send Key command to allow the device some time to “catch up” with the script.

If you need to perform a swipe before your Find Text and Touch command can locate a hyperlink, insert a swipe, and next, in Find Text and Touch, insert sufficient time in the **Timeout** tab for the hyperlinked text to be found. Optionally, implement error messaging in case the command fails.

NOTE You can use a Wait command to insert wait time before a Wait State command.

Figure 2-6 Wait Time in Find Text and Touch



Label: FindTextAndTouch

Wait Time (seconds): 45

Timeout Action: ○ Continue with script ● Return failure immediately

Main Category: CustomCategory

Error Type: CustomErrorType

Severity: 5 - Major

Description:

☑ Add Notes: Find Text and Touch failed to find text

Wait time

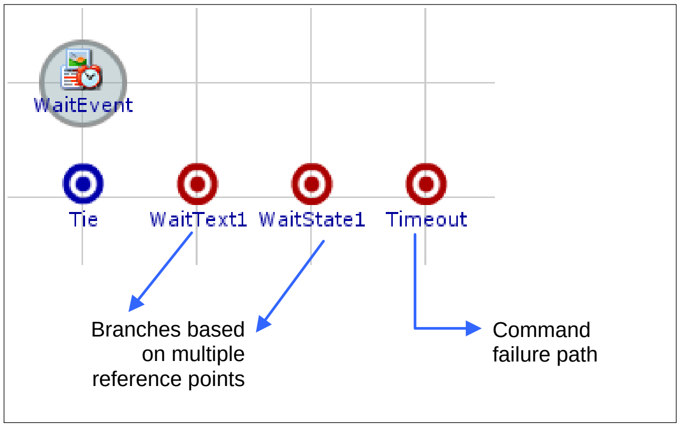
Error messaging

Multiple Possible Match Outcomes (Use Wait Event Command)

Use the Wait Event command in place of the Wait Text or Navigate To commands when there are multiple possible outcomes for a sequence of device interactions. The Wait Event command offers the same functionality as Wait Text with additional flexibility and robustness.

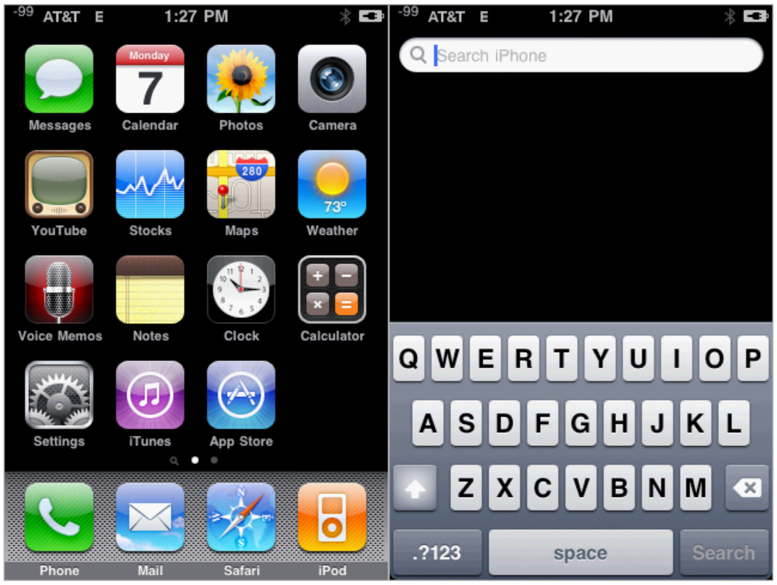
- Wait Event allows you to create branches based on multiple reference points (image, text, or audio). This is especially useful when defining reference points for multiple possible outcomes.
- Wait Event allows you to define a failure path in the Timeout branch.
- Use the Tie branch to continue with the script after a branch has been taken.

Figure 2-7 Wait Event Branches



Use the Wait Event command when a specific key sequence can have multiple outcomes. For instance, pressing the Home key on an iPhone toggles between the home and main search screens (see image below). You can use a Wait Event command to create a reference point for each of these screens.

Figure 2-8 Home Button Toggles Between Application and Search Screens on iPhone



Device Orientation

Changing device orientation (e.g., using the Hardware Extension command) does not normally impact text extraction as Keynote DeviceAnywhere automatically updates the device screen to match the orientation.

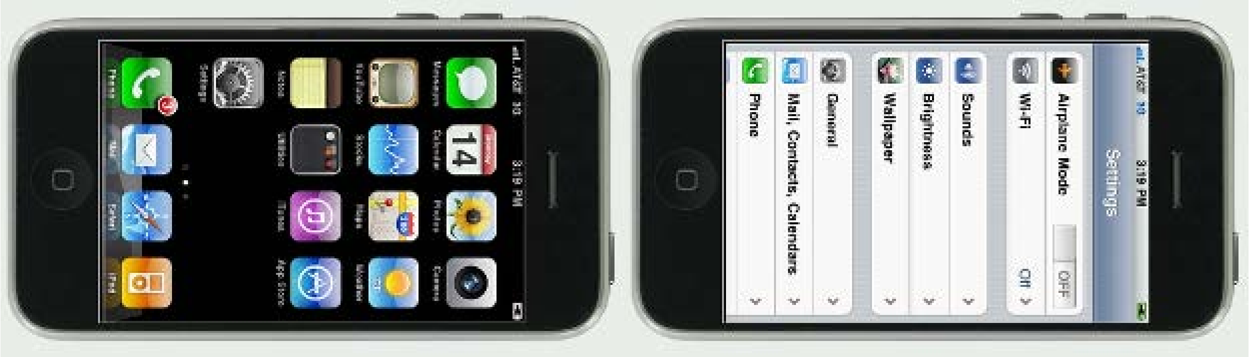
NOTE Accelerometer is supported on hardware-integrated and hybrid devices. On software-integrated devices:

- Accelerometer supported for software-integrated iPhones; you can change orientation of some software-integrated Androids but video is not rotated.
- Flip open/close (with screen rotation) supported for software-integrated Androids.

However, some screens can only be viewed in the default orientation. Consequently, any reference text captured in the default orientation will fail if you rotate the device as the screen is not updated.

For example, the iPhone home or settings screen can only be viewed correctly when the device is vertical. If you flip the device on its side, these screens are not updated (see image below). Any reference text captured while the device is in portrait orientation will fail if the orientation is changed for a script run.

Figure 2-9 Some Screens Do Not Change Orientation When the Device is Rotated



Scrolling to Find Reference Text

If you need to scroll to find a string of reference text on a Web page (e.g., using the Navigate To command), always implement a greater number of scrolls than it takes you to find the text during script development. This allows you to factor in dynamic changes to page length that impact where your text lies. For example, if it takes you 5 scrolls to find a string of text from search results on eBay, implement your script with 10 scrolls to account for runtime changes to the number of search results.

3 Guidelines for Transforming Text

This section discusses text transformation, selecting a color in the course of transformation, and setting tolerance levels.

Text transformation aims to render device text black on a white background, vice versa, or in color with increased contrast to assist with character recognition. The OCR engine uses several helper algorithms for text recognition. One of its assumptions is that on any screen, there is a demarcation between light and dark colors, and the text belongs to whichever (light or dark) occupies a smaller area on the device screen. Another assumption is that when dark and light areas of the screen are equal in area, text is dark.

As a result, the OCR engine has an easier time recognizing text (or choosing the correct demarcation point) when its color is farther from the background, or when areas of background are not mistakenly assumed to be areas of text. Therefore, the aim of transformation is to render the screen in black and white or in color with increased contrast between text and background, while minimizing background areas that can mistakenly be evaluated as text.

When defining reference text, we recommend that you *always* transform the device screen captured (**Transform Image Before Text Extraction**) to facilitate text recognition, even on screens that have black text on a white background.

- Transformation gives the OCR engine precise parameters.
- The tolerance sliders in each method of transformation also build in a margin of error in case the device screen changes slightly.

To transform text, you can:

- Select the *color of text* to be extracted. The tolerance slider sets the threshold for variation in the text color selected. See Selecting Text Color below for details on selecting a color and using the slider.
- Specify the *background color* of the area from which text is to be extracted. The tolerance slider sets the threshold for variation in the background color selected. See Selecting Text Background Color for details on selecting a background color and using the slider.
- Convert a colored device screen image to *black and white*. The tolerance slider is set by default to 0. Selecting a color that divides black from white and using the slider are discussed in detail in Converting to Black and White.
- Adjust the *contrast* of the device screen. The tolerance slider is set by default to 0. Selecting a color for adjusting tolerance and using the slider are discussed in detail in Adjusting Contrast.

While the following sub-sections provide specific instructions on using the tolerance slider for each transformation type, in general, we recommend that:

- Adjust tolerance sliders in small increments (e.g., up to the next notch on the scale).
- Adjust the sliders to the extent required to reliably extract the text you want.

3.1 Transformation by Selecting Text Color

Use this transformation method when the text string you want is marked by any of the following:

- Text of a uniform color, e.g., uniformly colored dark text on a light background or vice versa

- Text of a single color from a screen/area with multicolored text

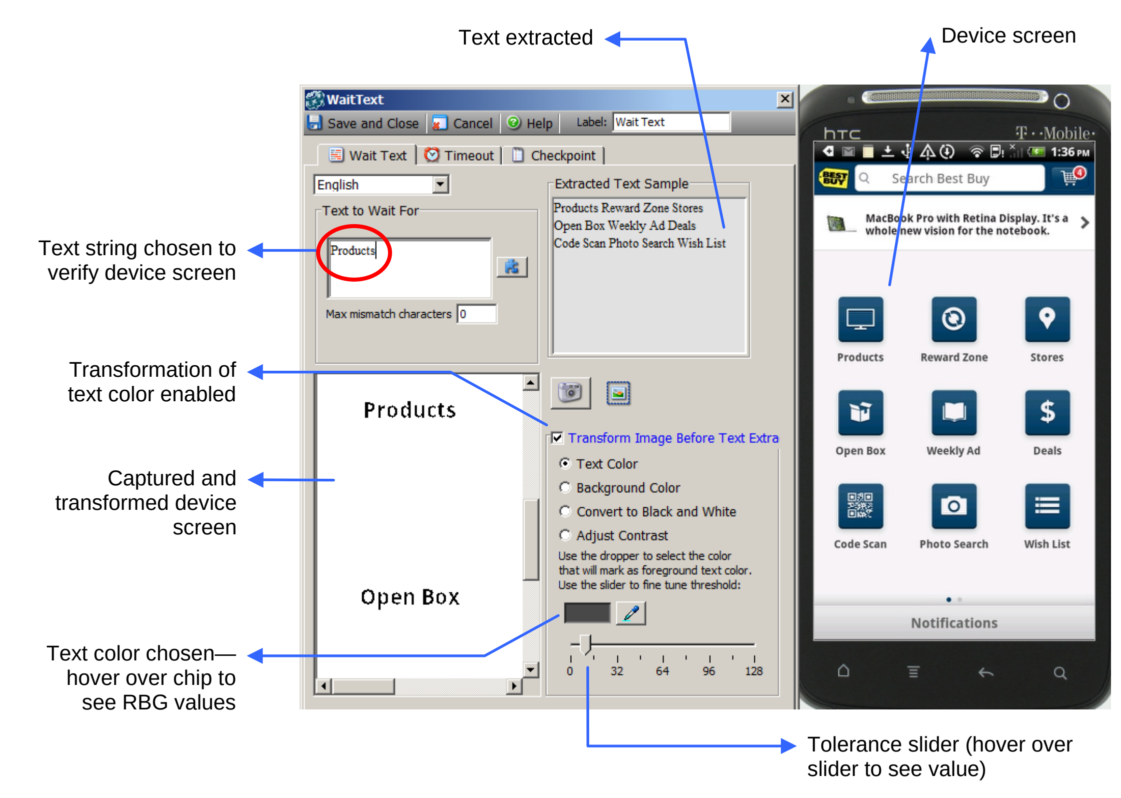
  Searching for both black and white text or searching for several colors of text in the same command is not recommended. If you need to extract text of two different colors, you might need to use a separate command for each color.

With the eyedropper tool, select the color of the text that you want to use to identify the device screen (follow the guidelines in Choosing a Text String when deciding on which string to wait for). The selected text color is displayed in the color chip next to the eyedropper icon. When you choose a color with the eyedropper tool, the captured device screen is rendered black and white to assist extraction.

The tolerance slider in this method of transformation sets the threshold for variation in the text color selected.

- The slider is set by default to a level of 10.
- We recommend that you do not decrease tolerance—text color often appears uniform but is not, and the default setting allows for this variability.
- Increase the slider value if you are not able to pick the exact text color you want, or if the string you want is not extracted.
- Increase the slider to the extent required to reliably extract the text you want (text is dynamically extracted as you adjust the slider).

Figure 3-1 Transforming Text Color (Wait Text)



WaitText

Label: Wait Text

English

Text to Wait For: Products

Max mismatch characters: 0

Extracted Text Sample:

Products Reward Zone Stores
Open Box Weekly Ad Deals
Code Scan Photo Search Wish List

☑ Transform Image Before Text Extra

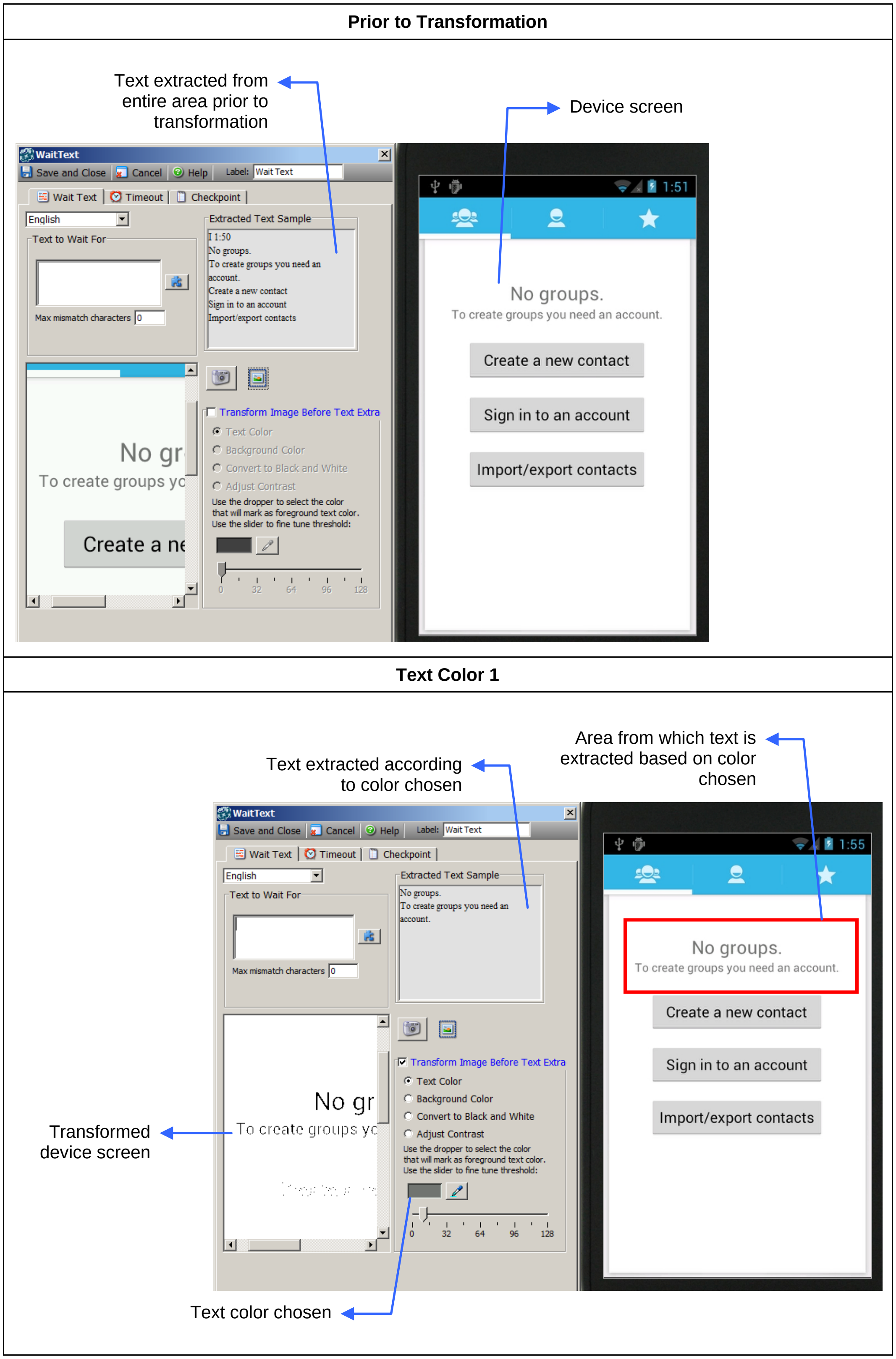
● Text Color
○ Background Color
○ Convert to Black and White
○ Adjust Contrast

Use the dropper to select the color that will mark as foreground text color. Use the slider to fine tune threshold:

Text extracted
Device screen
Save and Close
Cancel
Help
Wait Text
Timeout
Checkpoint
Products
Open Box
0
32
64
96
128
Text string chosen to verify device screen
Transformation of text color enabled
Captured and transformed device screen
Text color chosen—hover over chip to see RBG values
Tolerance slider (hover over slider to see value)
htc
T · · Mobile ·
1:36 PM
Search Best Buy
MacBook Pro with Retina Display. It's a whole new vision for the notebook.
Products
Reward Zone
Stores
Open Box
Weekly Ad
Deals
Code Scan
Photo Search
Wish List
Notifications

In the images below, note the extraction results prior to transformation, then after selecting each text color—when a text color is chosen, text primarily of that color is extracted:

Figure 3-2 Extraction Results Prior To and After Selecting Text Color



Prior to Transformation

Text extracted from entire area prior to transformation

Device screen

WaitText

Extracted Text Sample

I 1:50
No groups.
To create groups you need an account.
Create a new contact
Sign in to an account
Import/export contacts

☐ Transform Image Before Text Extra

● Text Color
○ Background Color
○ Convert to Black and White
○ Adjust Contrast

Use the dropper to select the color that will mark as foreground text color. Use the slider to fine tune threshold:

Text Color 1

Text extracted according to color chosen

Area from which text is extracted based on color chosen

WaitText

Extracted Text Sample

No groups.
To create groups you need an account.

☑ Transform Image Before Text Extra

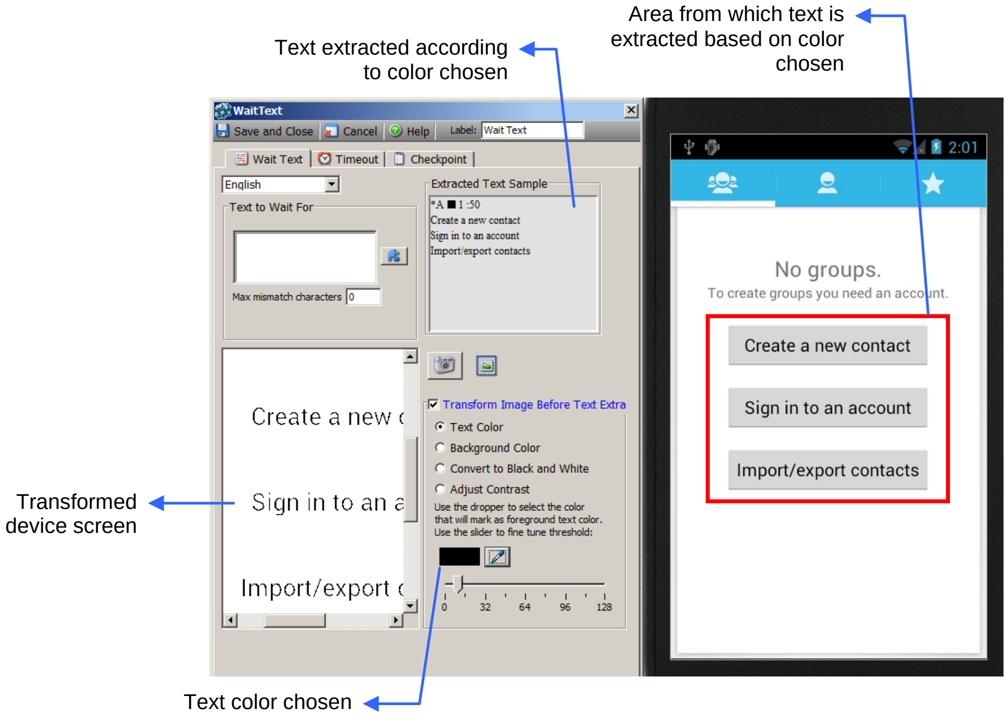
● Text Color
○ Background Color
○ Convert to Black and White
○ Adjust Contrast

Use the dropper to select the color that will mark as foreground text color. Use the slider to fine tune threshold:

Transformed device screen

Text color chosen

Text Color 2


Text extracted according to color chosen
Area from which text is extracted based on color chosen
Transformed device screen
Text color chosen
WaitText
Save and Close
Cancel
Help
Wait Text
Timeout
Checkpoint
Text to Wait For
2:01

Label: Wait Text

English

Max mismatch characters 0

Extracted Text Sample

*A ■ 1 :50
Create a new contact
Sign in to an account
Import/export contacts

Create a new c
Sign in to an a
Import/export c

☑ Transform Image Before Text Extra

● Text Color
○ Background Color
○ Convert to Black and White
○ Adjust Contrast

Use the dropper to select the color that will mark as foreground text color. Use the slider to fine tune threshold:

0 32 64 96 128

No groups.
To create groups you need an account.

Create a new contact
Sign in to an account
Import/export contacts

3.2 Transformation by Selecting Background Color

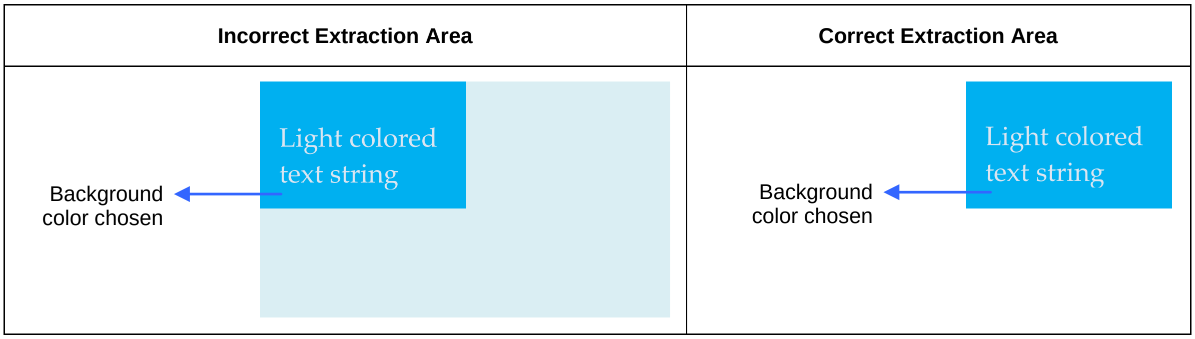
Use this transformation method when the text string you want is marked by all of the following:

- Light or multicolored text on a dark background—in this case, transformation reverses tonality to facilitate character recognition
- A majority of the background/screen area being of a uniform color

With the eyedropper tool, select the background color of the text that you want to use to identify the device screen (follow the guidelines in Choosing a Text String when deciding on which string to wait for). The selected background color is displayed in the color chip next to the eyedropper icon. When you choose a color with the eyedropper tool, the captured device screen is rendered black and white to assist extraction.

Make sure that the color chosen is the background for more than 50% of the area selected (the extraction area). For instance, if your chosen dark background lies on top of a larger light background, the engine will fail, as it will assume that the text color is the darker color, which takes up less than 50% of the extraction area.

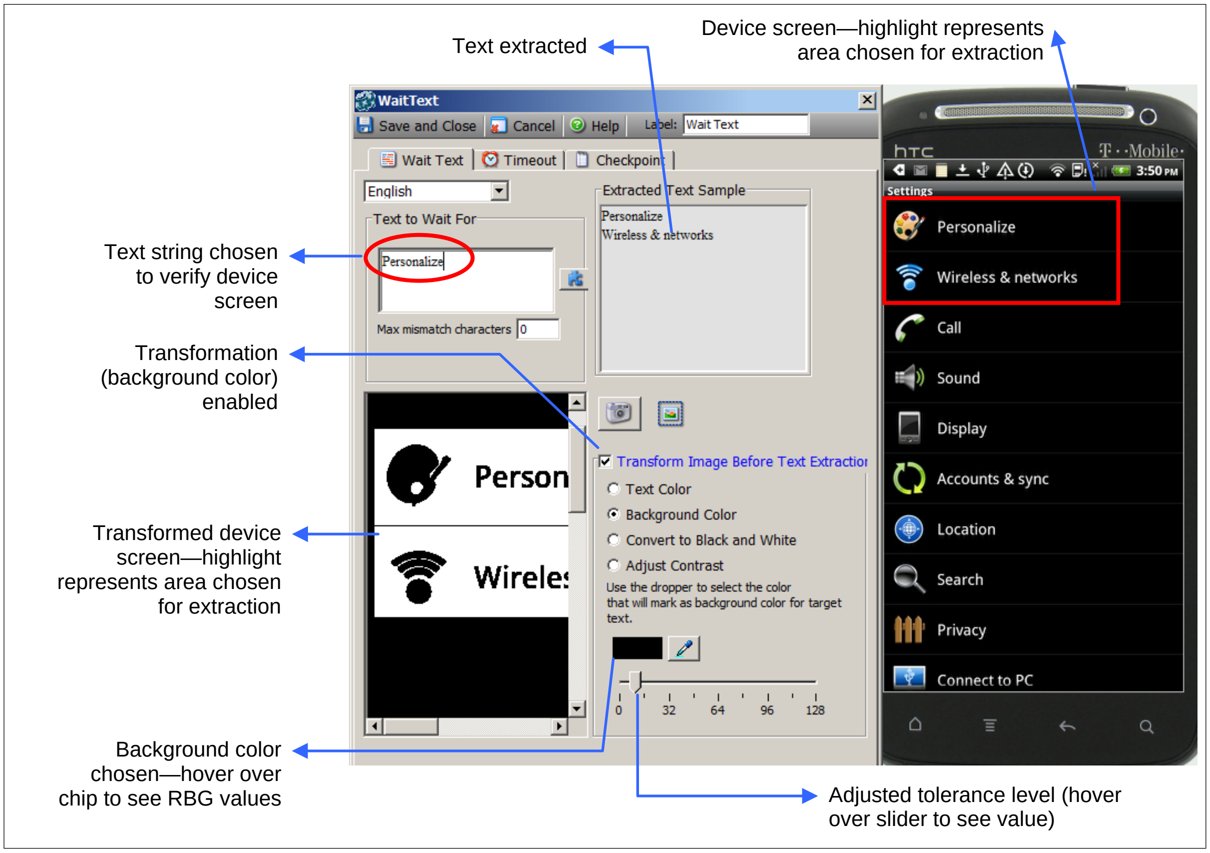
Figure 3-3 Color Chosen is the Background for More Than 50% of Extraction Area


Incorrect Extraction Area
Correct Extraction Area
Light colored text string
Background color chosen
Light colored text string
Background color chosen

The tolerance slider in this method of transformation sets the threshold for variation in the background color selected.

- The slider is set by default to a level of 10.
- We recommend that you do not decrease tolerance—many backgrounds often appear uniform but are not, and the default setting allows for this variability.
- Increase the slider value if you are not able to pick the exact background color you want, or if the string you want is not extracted.
- Increase the slider to the extent required to reliably extract the text you want (text is dynamically extracted as you adjust the slider).

Figure 3-4 Transforming Text Background (Wait Text)


Text extracted

Device screen—highlight represents area chosen for extraction

Text string chosen to verify device screen

Transformation (background color) enabled

Transformed device screen—highlight represents area chosen for extraction

Background color chosen—hover over chip to see RBG values

Adjusted tolerance level (hover over slider to see value)

Label: Wait Text

English

Text to Wait For: Personalize

Max mismatch characters 0

Extracted Text Sample: Personalize Wireless & networks

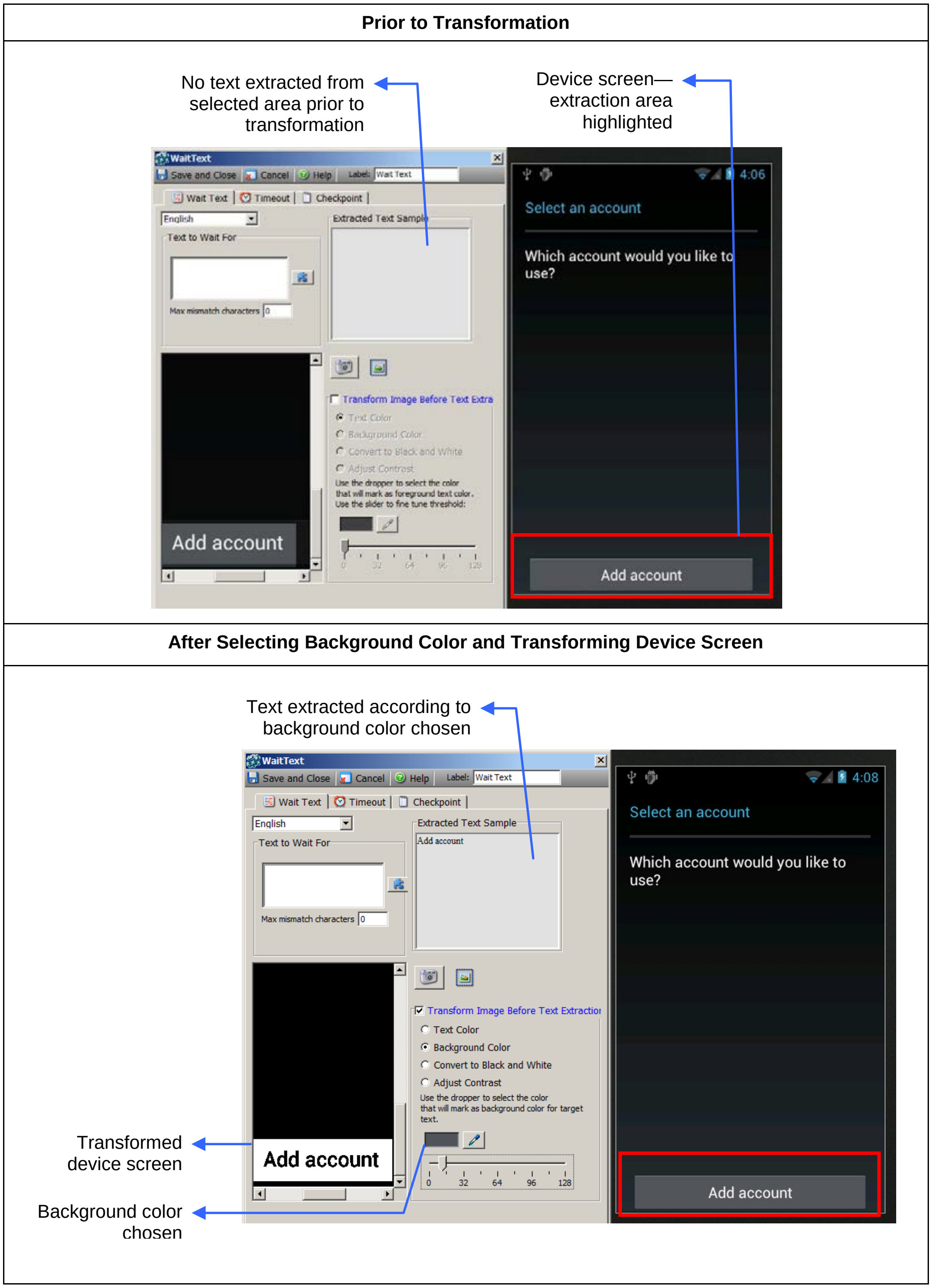
☑ Transform Image Before Text Extraction

○ Text Color
● Background Color
○ Convert to Black and White
○ Adjust Contrast

Use the dropper to select the color that will mark as background color for target text.

In the images below, note the extraction results and the captured device screen prior to transformation, then after selecting a background color. No text is extracted prior to transformation. Using transformation enables you to extract the desired text. The margin of error built in by the tolerance slider ensures that your reference point stays robust and reliable over a long period of time and many script runs.

Figure 3-5 Extraction Results Prior To and After Selecting Background Color


Prior to Transformation
No text extracted from selected area prior to transformation
Device screen—extraction area highlighted
After Selecting Background Color and Transforming Device Screen
Text extracted according to background color chosen
Transformed device screen
Background color chosen
WaitText
Save and Close
Cancel
Help
Wait Text
Timeout
Checkpoint
Text to Wait For
Max mismatch characters
Extracted Text Sample
Text Color
Background Color
Convert to Black and White
Adjust Contrast
Select an account
Add account

Label: Wait Text

English

Max mismatch characters 0

□ Transform Image Before Text Extra ● Text Color ○ Background Color ○ Convert to Black and White ○ Adjust Contrast

Use the dropper to select the color that will mark as foreground text color. Use the slider to fine tune threshold:

Which account would you like to use?

Extracted Text Sample: Add account

☑ Transform Image Before Text Extraction ○ Text Color ● Background Color ○ Convert to Black and White ○ Adjust Contrast

Use the dropper to select the color that will mark as background color for target text.

3.3 Transformation by Converting to Black and White

Use this transformation method when the text string you want is marked by any of:

- Several shades of light text on a darker multicolored or graded background, or vice versa, e.g., white and yellow text on a blue and gray background or vice versa. There is good contrast between the text and background color ranges.
- A background that changes slightly, e.g., iPhone 3G changes background tone when restarted
- Text and background colors often appear uniform but are not. This method of transformation allows you to take this variability into account.

(Follow the guidelines in Choosing a Text String when deciding on which string to wait for.)

With the eyedropper tool, select the color you want to use to divide black from white:

- Darker colors are turned black; lighter colors are turned white.
- Choose a color that differentiates (lies between) text and background.
  - If text is lighter than background, the color should be darker than text but in the lighter background range.
  - If text is darker than background, choose lightest shade of text possible.

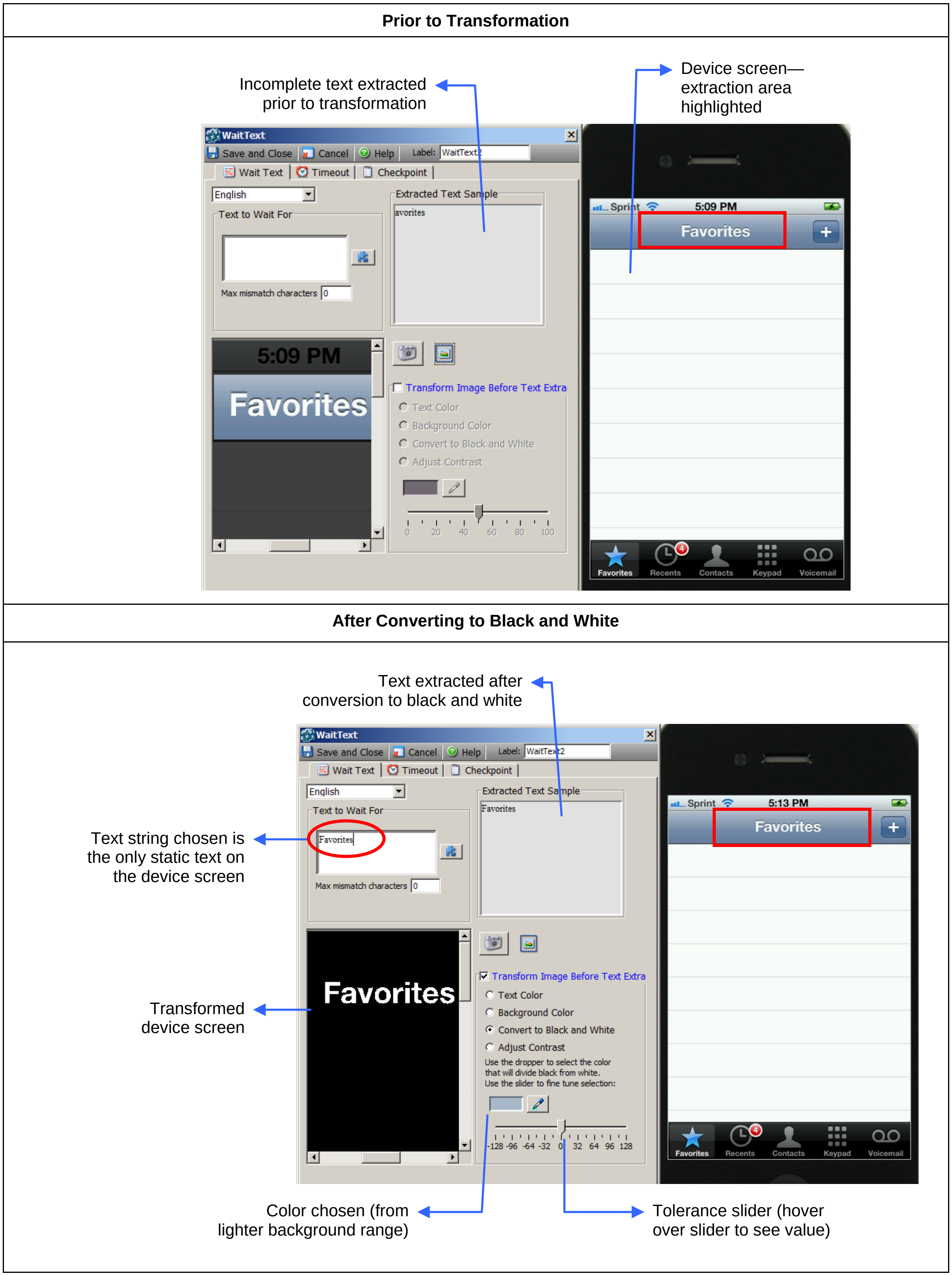
The selected color is displayed in the color chip next to the eyedropper icon. When you choose a color with the eyedropper tool, the captured device screen is rendered black and white.

The tolerance slider in this method of transformation sets the threshold for variation in the selected color.

- Use the slider if you are not able to pick the exact color you want, or if the string you want is not extracted.
- A negative value makes the selected color lighter; a positive value makes the selected color darker.

In the images below, note the extraction results and the captured device screen prior to transformation, then after converting to black and white:

Figure 3-6 Transforming to Black and White (Wait Text)



Prior to Transformation

Incomplete text extracted prior to transformation

Device screen—extraction area highlighted

WaitText — Label: WaitText2

English

Text to Wait For:

Max mismatch characters: 0

Extracted Text Sample: avorites

☐ Transform Image Before Text Extra

○ Text Color

○ Background Color

○ Convert to Black and White

○ Adjust Contrast

After Converting to Black and White

Text extracted after conversion to black and white

Text string chosen is the only static text on the device screen

Transformed device screen

WaitText — Label: WaitText2

English

Text to Wait For: Favorites

Max mismatch characters: 0

Extracted Text Sample: Favorites

☑ Transform Image Before Text Extra

○ Text Color

○ Background Color

● Convert to Black and White

○ Adjust Contrast

Use the dropper to select the color that will divide black from white.
Use the slider to fine tune selection:

Color chosen (from lighter background range)

Tolerance slider (hover over slider to see value)

3.4 Transformation by Adjusting Contrast

Use this transformation method when the text string you want is in an area where text and background are very close in tone and color (follow the guidelines in Choosing a Text String when deciding on which string to wait for).

With the eyedropper tool , select a color with respect to which you want contrast adjusted:

- Darker colors are turned darker; lighter colors are turned lighter.
- If your sample has a lot of text, choose text or background color.
- If your sample has relatively little text compared to background, choose background color.

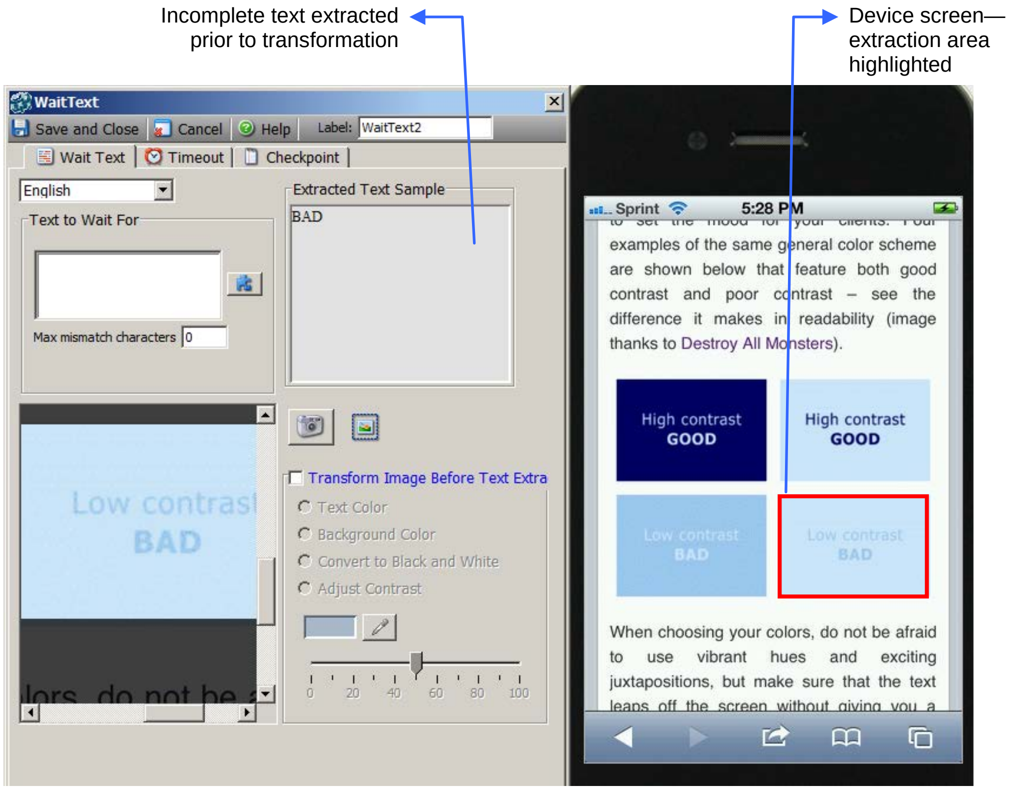
The selected color is displayed in the color chip next to the eyedropper icon.

NOTE When you choose a color with the eyedropper tool, the captured device screen is *not* rendered black and white. However, contrast is adjusted as you move the slider.

The tolerance slider in this method of transformation increases contrast. Use the slider to the extent required to reliably extract the text you want.

Figure 3-7 Adjusting Contrast (Wait Text)

Prior to Transformation



examples of the same general color scheme are shown below that feature both good contrast and poor contrast – see the difference it makes in readability (image thanks to Destroy All Monsters).

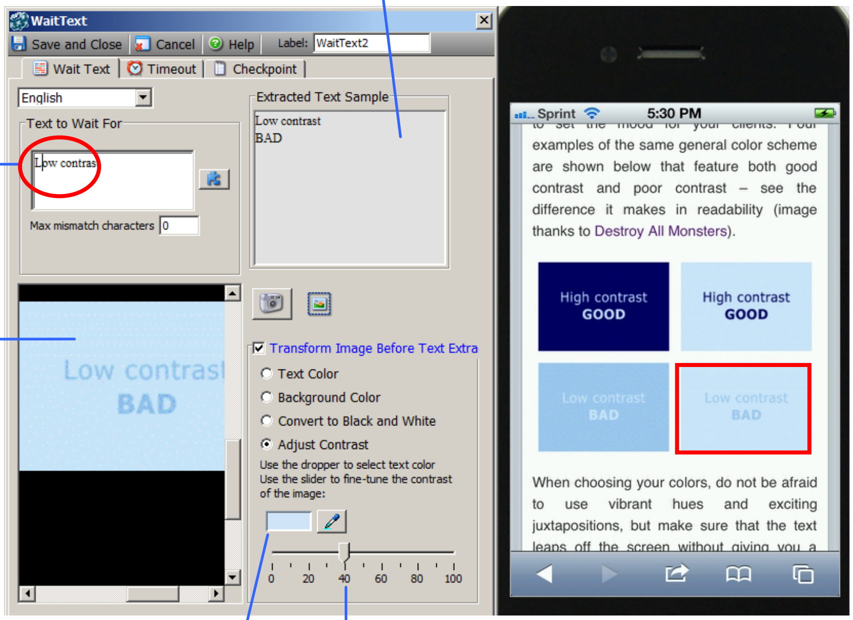
When choosing your colors, do not be afraid to use vibrant hues and exciting juxtapositions, but make sure that the text

After Adjusting Contrast

Text extracted after contrast adjustment

Text string chosen to verify device screen

Transformed device screen



Label: WaitText2

English

Text to Wait For: Low contras

Max mismatch characters 0

Extracted Text Sample: Low contrast BAD

Low contrast BAD

☑ Transform Image Before Text Extra

○ Text Color

○ Background Color

○ Convert to Black and White

● Adjust Contrast

Use the dropper to select text color
Use the slider to fine-tune the contrast of the image:

Sprint 5:30 PM

to set the mood for your clients. Four examples of the same general color scheme are shown below that feature both good contrast and poor contrast – see the difference it makes in readability (image thanks to Destroy All Monsters).

High contrast GOOD

High contrast GOOD

Low contrast BAD

Low contrast BAD

When choosing your colors, do not be afraid to use vibrant hues and exciting juxtapositions, but make sure that the text leaps off the screen without giving you a

Color chosen (background color)

Adjusted tolerance slider (hover over slider to see value)

4 Guidelines for Choosing a Text String

This section presents guidelines on optimal text selection to aid the OCR engine and to verify your scripts. It also discusses characteristics of text that render it more difficult to be recognized by the OCR engine.

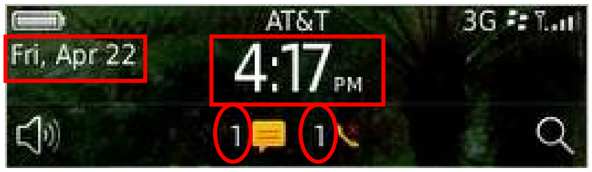
NOTE If you select a specific area of the device screen from which to extract text, the text string is matched at exactly the same location as on the reference screen. If you extract text from the entire device screen, reference text can lie at any position on the device screen. If the reference string is repeated on the device screen, the first instance is matched.

Static Text

Dynamic text that varies over time, e.g., date and time information in the status bar of a device screen or the number of hits for a youTube video, is unsuitable for use as a reference string and causes match failures.

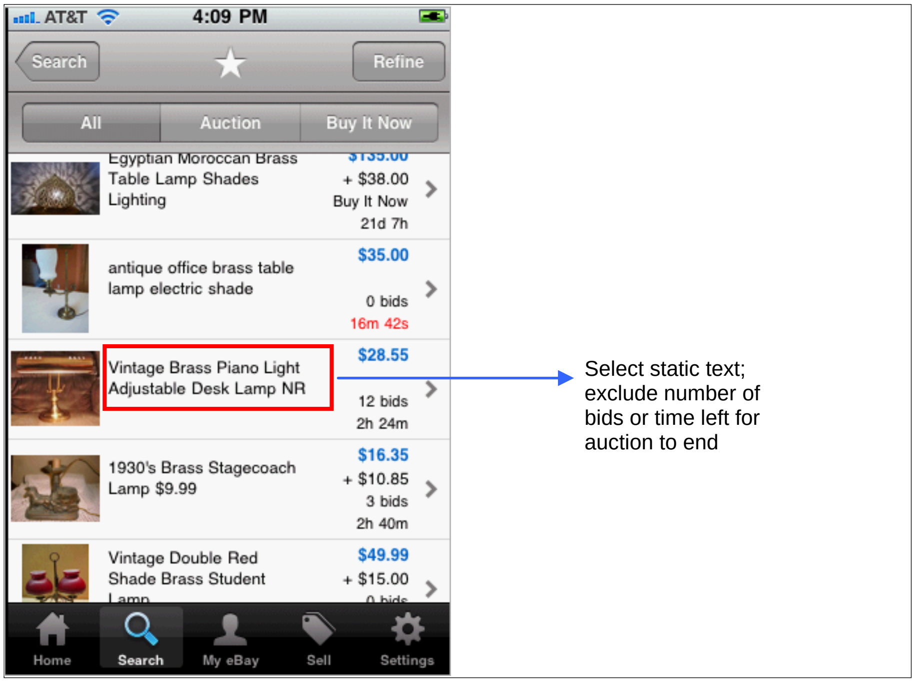
The image below shows the status bar of a BlackBerry Torch 9800. Text that is subject to change is highlighted.

Figure 4-1 Changing Screen Text



When choosing reference text, exclude any dynamic text, such as the number of bids and the time left for an eBay auction to end, as shown in the illustration below.

Figure 4-2 Select Static Text—Example 1


AT&T
4:09 PM
Search
Refine
All
Auction
Buy It Now
Egyptian Moroccan Brass Table Lamp Shades Lighting
$135.00
+ $38.00
Buy It Now
21d 7h
antique office brass table lamp electric shade
$35.00
0 bids
16m 42s
Vintage Brass Piano Light Adjustable Desk Lamp NR
$28.55
12 bids
2h 24m
1930's Brass Stagecoach Lamp $9.99
$16.35
+ $10.85
3 bids
2h 40m
Vintage Double Red Shade Brass Student Lamp
$49.99
+ $15.00
0 bids
Home
Search
My eBay
Sell
Settings

Select static text; exclude number of bids or time left for auction to end

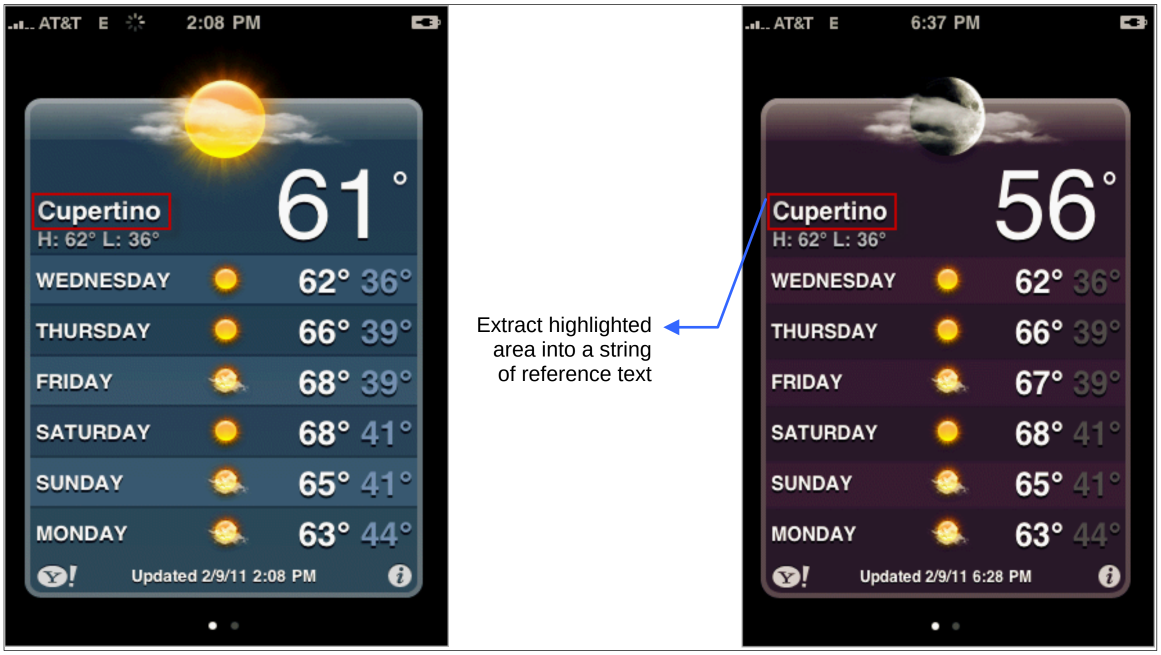
Some device screens have relatively little stable information and can change depending on certain conditions.

In such cases, your options are to:

- Turn off the background change option in your application, if possible.
- Match to a string of static text extracted from the screen.
- If there is no static information on a screen, try to implement a reference point either before or after that point in your script.

The images below show how the iPhone weather application changes background, images, and text, with the only static information being the name of the city. In this case, use the name of the city (e.g., Cupertino) to define a string of reference text to be matched.

Figure 4-3 Select Static Text—Example 2



Extract highlighted area into a string of reference text

NOTE You can, however, wait for and pass dynamic text, such as an airline confirmation number, to a variable using the Extract Text command. If you do not know what the text is beforehand but know the pattern it follows, you can define it using a regular expression. Or you can define it in terms of the text that precedes and/or follows it.

Dictionary Words

While your text string can have multiple words with numbers as well as symbols, the extraction engine tries to match dictionary words and finds it harder to recognize non-dictionary words. Instead of waiting to verify a non-dictionary alphanumeric string, try to extract the text that comes before or after it to assist the recognition engine.

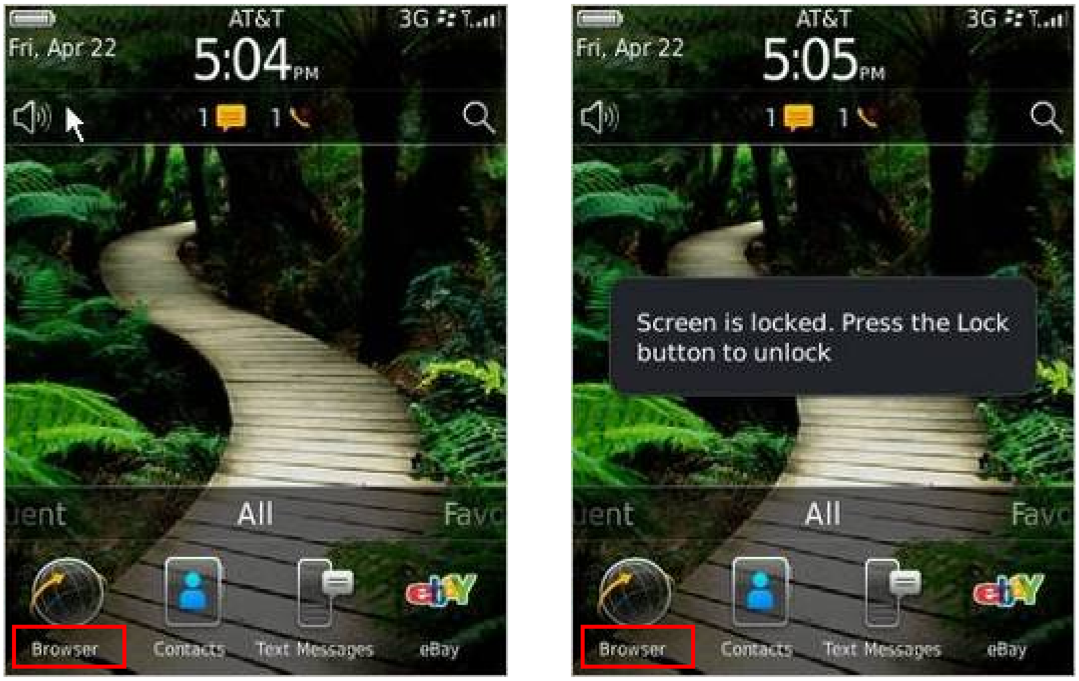
NOTE You can, however, wait for and pass a non-dictionary string, such as an airline confirmation number, to a variable using the Extract Text command. See Static Text, above.

Unique Text

To better serve the purpose of script verification, choose text that uniquely identifies a screen. If a screen contains multiple instances of selected string, the first instance is matched.

In the images of a BlackBerry Torch home screen below, the chosen text (highlighted) does not differentiate between a locked and unlocked screen. While the locked screen can be better identified by the text "Screen is locked…," there is no text that *uniquely* identifies the unlocked home screen. You need to use a reference image to identify the unlocked home screen instead.

Figure 4-4 Text That Does Not Uniquely Identify Screen



Screen is locked. Press the Lock button to unlock

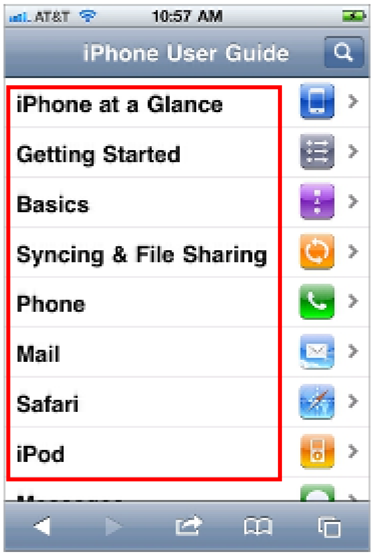
NOTE If your text string is unique (i.e., not likely to be matched to some other text on the same screen), you can build in a margin of error by specifying the maximum number of characters that can be mismatched (**Max mismatch characters**). For example, if you specify that any 8 out of 10 characters can be matched in the string "California," the term "Callfornla" will be considered a match.

As with the tolerance sliders, use this control cautiously as allowing for too many mismatch characters can lead to false positive matches.

Dark or Uniform Colored Text

The character recognition engine works best when extracting text of a uniform color and text that is darker than the background. Light or multicolored text is harder to recognize.

Figure 4-5 Select Dark Text on a Light Background



AT&T 10:57 AM

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However, not all screens fit these criteria, and the transformation tools available in commands and in states enable you to render text black on a white background (or vice versa) to assist with recognition. You can also control for variability in text by choosing a specific screen region from which to extract text.

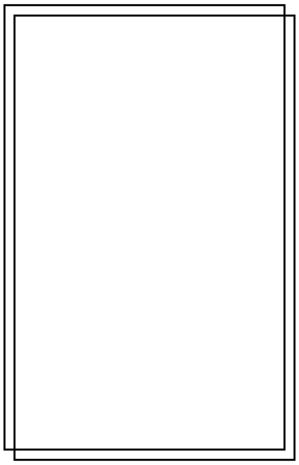
NOTE If you select a specific area of the device screen from which to extract text, the text string is matched at exactly the same location as on the reference screen. If you extract text from the entire device screen, reference text can lie at any position on the device screen. If the reference string is repeated on the device screen, the first instance is matched.

If you need to extract text of two different colors, you might need to use a separate command for each text color.

Reference Text Defined at the Edge of a Device Screen

Some identical hardware-integrated devices might not have strictly overlapping screens. Screen edges can be slightly offset from each other on two devices of the same make and model. A text string chosen from the screen edge of one such device might be matched on another.

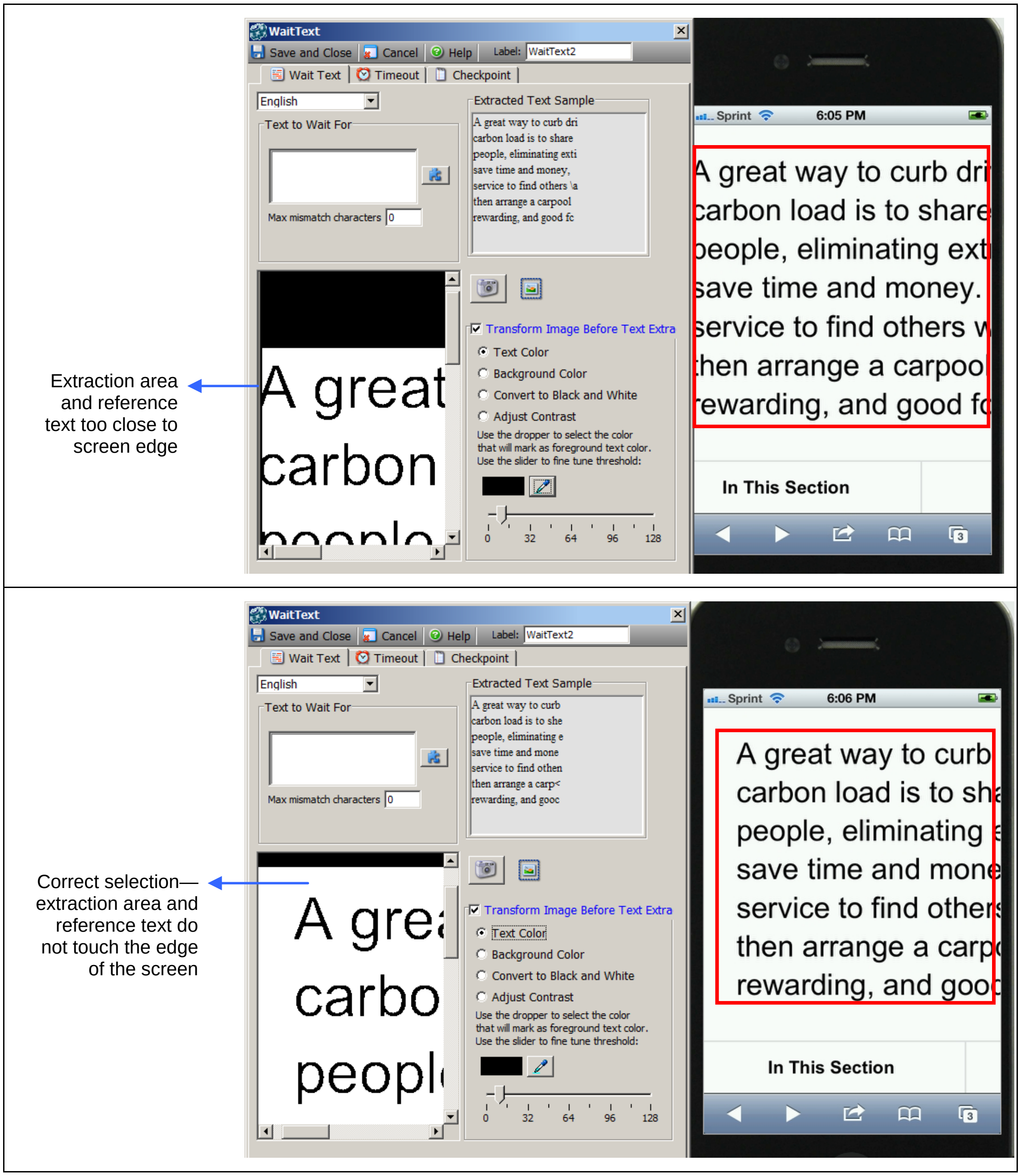
Figure 4-6 Screen Edges Not Perfectly Aligned



To avoid possible areas of mismatch in these cases:

- Do not choose a string of reference text that touches the edge of the device screen.
- Do not define a text extraction area at the edge of the device screen.

Figure 4-7 Avoid Selecting the Edge of the Device Screen



Extraction area and reference text too close to screen edge

Label: WaitText2

English

Max mismatch characters 0

Extracted Text Sample

A great way to curb dri
carbon load is to share
people, eliminating exti
save time and money,
service to find others \a
then arrange a carpool
rewarding, and good fc

☑ Transform Image Before Text Extra

● Text Color
○ Background Color
○ Convert to Black and White
○ Adjust Contrast

Use the dropper to select the color that will mark as foreground text color. Use the slider to fine tune threshold:

Correct selection—extraction area and reference text do not touch the edge of the screen

Label: WaitText2

English

Max mismatch characters 0

Extracted Text Sample

A great way to curb
carbon load is to she
people, eliminating e
save time and mone
service to find othen
then arrange a carp<
rewarding, and gooc

☑ Transform Image Before Text Extra

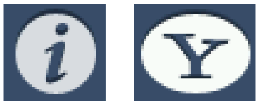
● Text Color
○ Background Color
○ Convert to Black and White
○ Adjust Contrast

Use the dropper to select the color that will mark as foreground text color. Use the slider to fine tune threshold:

Large or Graphic Text

Avoid selecting oversized or highly stylized text as it can be mistaken for a graphic. Likewise, some graphics can be mistaken for or interfere with text recognition.

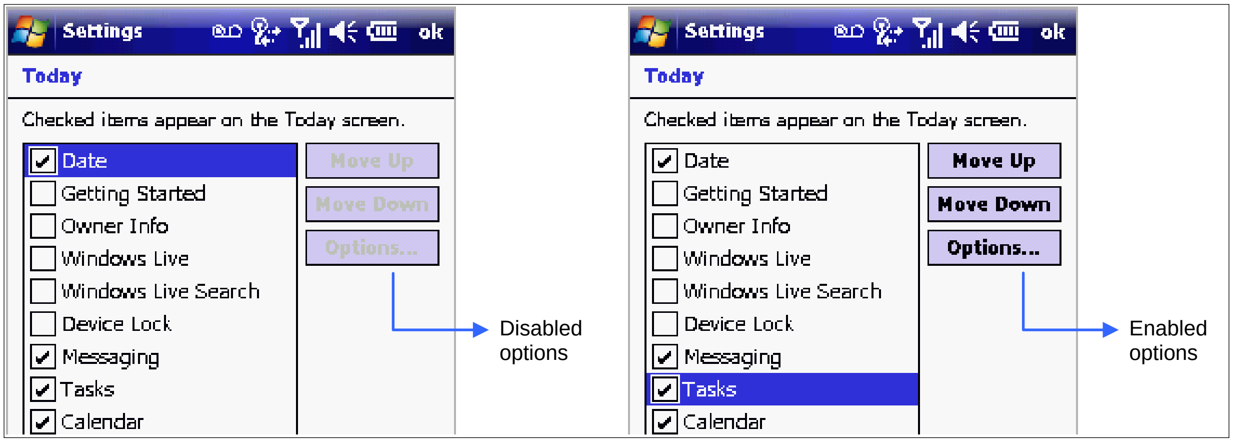
Figure 4-8 Avoid Selecting Stylized Text



Grayed out UI Options

UI options on device screens can be grayed out until the corresponding action is valid. In the example below, action buttons are enabled depending on the item selected.

Figure 4-9 Device Screen Changes Based on Disabled/Enabled Options



Today

Checked items appear on the Today screen.

☑ Date
□ Getting Started
□ Owner Info
□ Windows Live
□ Windows Live Search
□ Device Lock
☑ Messaging
☑ Tasks
☑ Calendar

Disabled options

Today

Checked items appear on the Today screen.

☑ Date
□ Getting Started
□ Owner Info
□ Windows Live
□ Windows Live Search
□ Device Lock
☑ Messaging
☑ Tasks
☑ Calendar

Enabled options

When choosing a text string, ensure that UI elements are in the same state in your command/state as on the device screen or your script might fail. If a menu option is enabled in your command, ensure that your script enables it on the device screen as well.