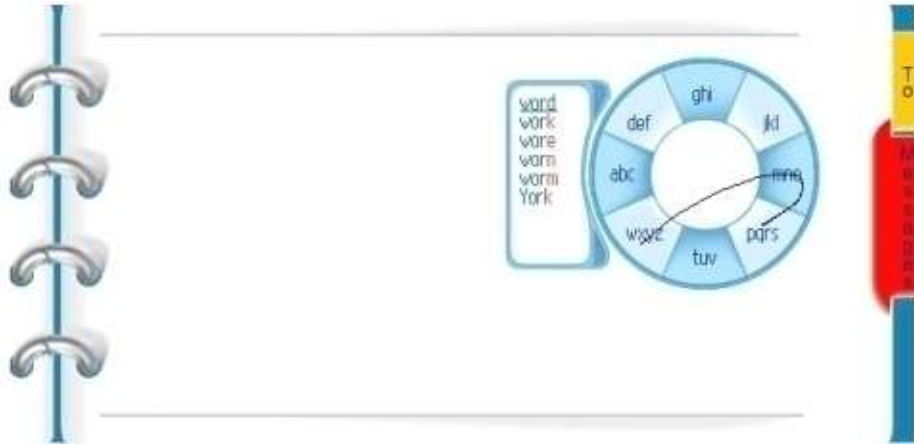


## The Ring-Writer input system

This manual describes the Ring-Writer system for pen-based machines. The Ring-Writer system provides a convenient and rapid writing method for text input, including punctuation, and handles program control via action gestures and commands. An intuitive set of editing gestures completes the interface, making Ring-Writer the first true pen-based input system.



The picture above shows an adaptation of the system for a mobile phone without a keypad, equipped with a pen and digitizer screen. The messaging application uses Ring-Writer for word input, text editing, and control.

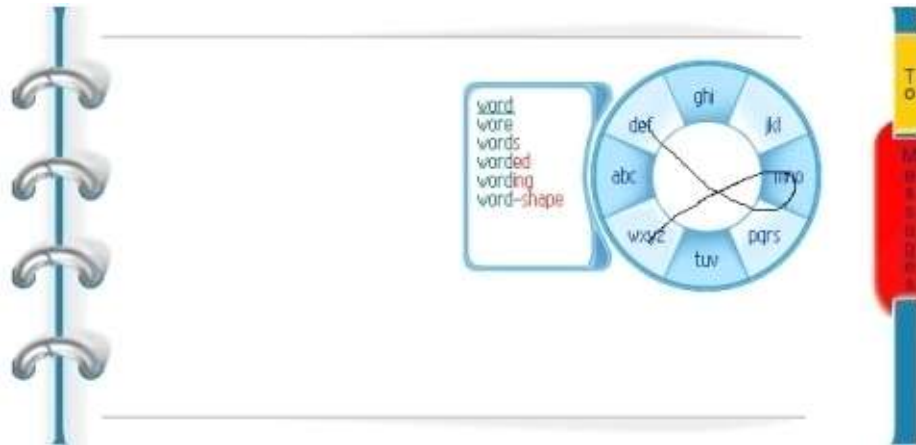
The Ring-Writer interface uses a ring of eight sectors corresponding to the letter groups [abc] to [wxyz]. The user writes a word by tapping on the sectors, or by drawing pen strokes corresponding to the combinations of letters forming the word, thus forming what we shall call “word shapes”. For example, the illustration above shows a single pen stroke used to obtain the word “word”.

The stroke starts in sector [wxyz], and traverses [mno] to terminate in [pqrs]. The system generates a list of words corresponding to (or starting with) one of the possible sequences of letters defined by these letter groups. As it happens, there are no three-letter words for the given combination, so the list starts with the most common four-letter words. “Word” is most likely, and the alternates are work, wore, worn, worm, and York. At this stage, a tap of the pen inside the sector ring will send “word” to the message area.

Note that in this particular case, it is not necessary to specify all the letters in the word: in fact, just the first three letters, ‘w’, ‘o’ and ‘r’ are enough to obtain “word” as the proposal. This situation occurs quite often, and it is rarely necessary to go beyond five or six letters in order to be sure of finding the required word amongst the alternates. Moreover, since the words are stored in order of frequency of use, the required word will often be the proposal. To remind the user of the letters so far defined, alternates are shown with the extra letters in red.

To send the proposed word to the text area, the user can either tap in the central area of the sector ring, or on the proposal itself. To send one of the alternates to the text area, the user taps on the alternate.

For the sake of completeness, look at what happens if we draw the entire word-shape for “word”:



“Word” is still the first choice, but now we have only one other four-letter alternate, and all the other suggestions start with the four letters “word”. This illustrates the “look ahead” feature of Ring-Writer, which is particularly useful in languages where verbs are conjugated or nouns are declined. Here, tapping on “word-shape” would send that word to the text area, a ten-letter word for a very simple shape (note that the hyphen does not need to be entered explicitly).

The next example illustrates some writing techniques:



The word “hello” can be easily drawn with a single stroke. The double letter ‘l’ is achieved by exiting and re-entering the sector [jkl]. This technique of going outside of the input circle is very convenient, not only for double letters, but for other letter combinations using the same sector, such as “ed”, “pr” or “sp” (twice in sector [pqrs]), and even “mon” (three times in [mno]). Note the simplicity and elegance of the word shape for “hello”: it is very like a hand-written letter ‘d’, and takes about the same time to write. Note also that this combination of sectors gives only the word “hello”, with no alternates..

The shape for “world” uses a loop to traverse the sectors [mno] and [pqrs], and to exit in such a way as to continue directly towards sector [jkl]. Opportunities for loops occur very often.

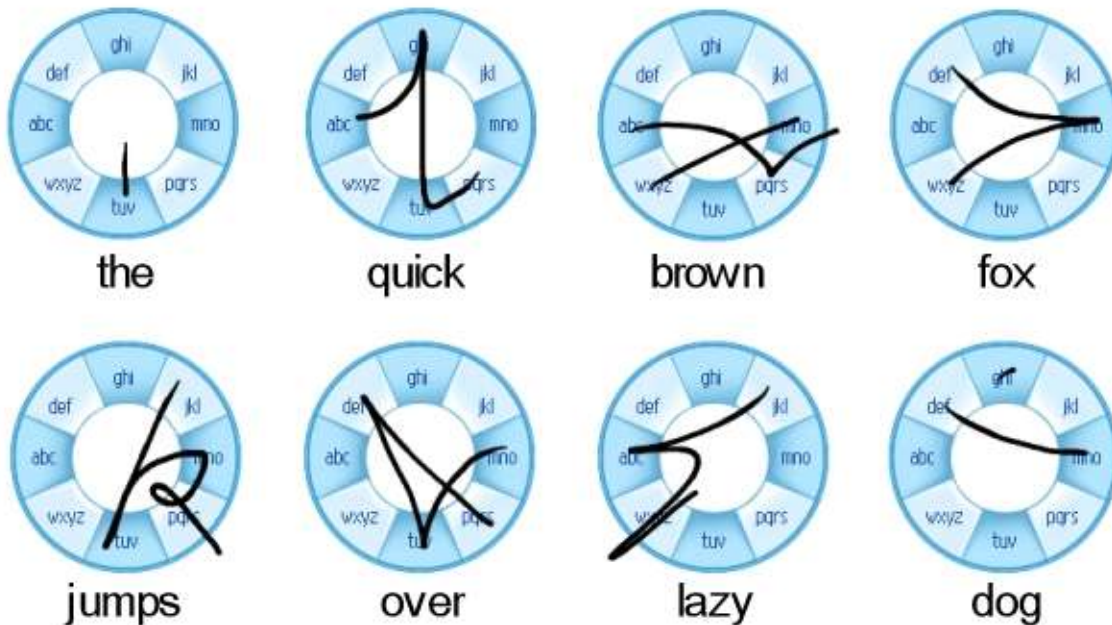
Sometimes, it is easier to break words into syllables, for convenience and comfort, but also because one tends to automatically learn the shapes of frequently occurring letter combinations. Of course, many long words are much too awkward to enter in a single stroke, but with luck, it may not be necessary to enter the whole world. Take the

following example, which shows how to obtain the word “international”:



The shape for “int” produces “get” as favoured proposal, which is quite normal. Following this with a looped stroke corresponding to the letter combination “erna” gives the alternates list shown at the right. A simple tap on “international” will send the required word to the text area.

The following example shows the word shapes corresponding to the phrase “the quick brown fox jumps over the lazy dog” (leaving out the second “the”):



A few notes relating to these word shapes:

1. The word “the” can be obtained with a single stroke into the [tuv] sector, or simply by tapping inside the sector. The dictionary is organized so that words are proposed first according to length, then according to frequency of utilisation. “The” is special, since it is the most common word in the English language: the letter “t” is thus defined as an abbreviation (see next section).
2. The shape for “quick” only defines the first four letters. This is enough. Simple shapes for common words like this are quickly learnt by heart.
3. Two strokes have been used for “brown”, whereas “fox” is nicely drawn with a single cusped shape.

4. In the word-shape for “jumps”, notice the use of the small loop to re-enter the final sector [pqrs]. You could also of course tap on [pqrs] to add an ‘s’ to “jump”.
5. “Over” is a fairly common word, and this shape would probably be committed to memory by many users.
6. “Lazy” contains another double-sector combination “zy”.
7. The word “dog”, even though it is short and simple, is conveniently written by starting with “do”, then tapping in sector [ghi] to add the letter ‘g’.

### Abbreviations

The system provides a method for defining and using abbreviations, and word contractions (it’s, don’t etc). Dictionary entries for abbreviations are marked such that when an abbreviation shape is drawn in the writing area, it is automatically replaced by its associated full string.

The system will provide some standard abbreviations, but the facility is mostly intended for the user’s own definitions. As an example of a standard abbreviation, we might have ‘ys’ for “Yours Sincerely,”. The stroke shown in the following example would then result in this useful string:

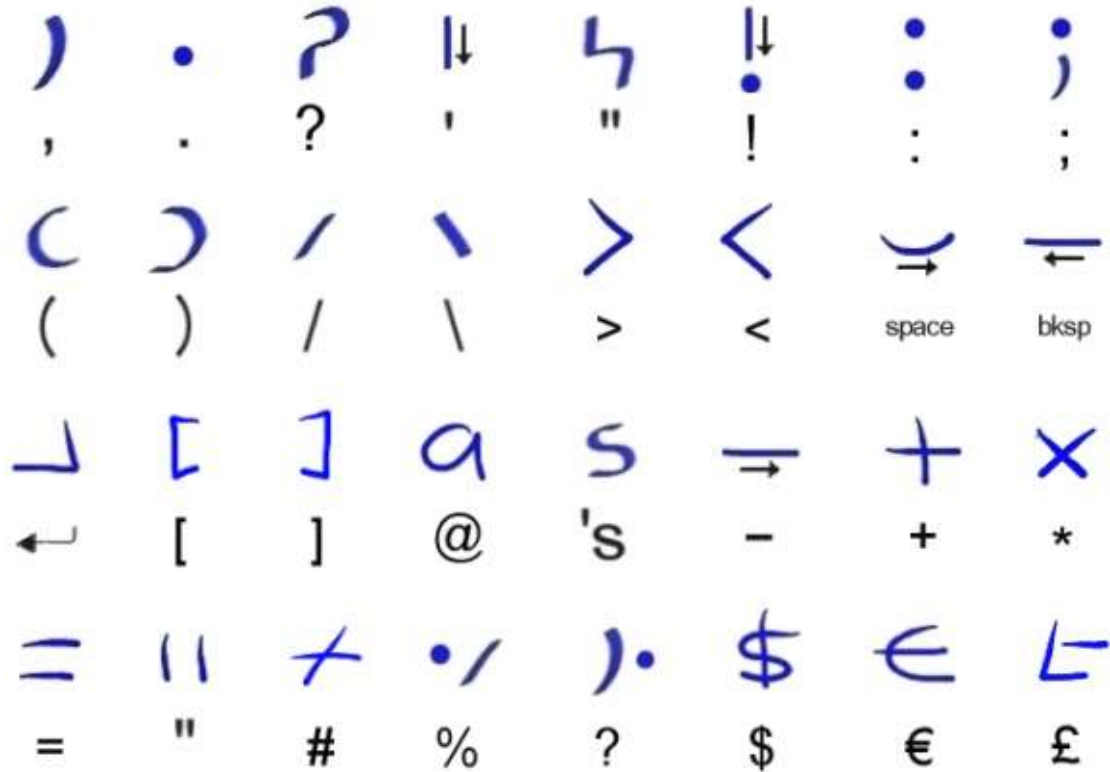


The system uses internal abbreviations in a few special cases:

- (1) Word contractions, like “he’s” or “don’t”. In these cases, the user would just enter the word without worrying about the apostrophe: the system will know that it is required. (Note that a few contractions, like “it’s” and “we’ll” will appear as alternates to an ordinary word formed from the same letters).
- (2) Hyphenated words, or words containing periods: (“word-shape”, “G.I”, “U.S.A”). Note that upper-case letters appearing in the dictionary are always retained in the proposed text.
- (3) Some words resulting from a tap in a sector (or a stroke entering the sector) are in fact abbreviations. This means that some very common words will appear ahead of shorter, but less common, words. Thus, [tuv] is defined as a system abbreviation for “the”, and [mno] is “of”.

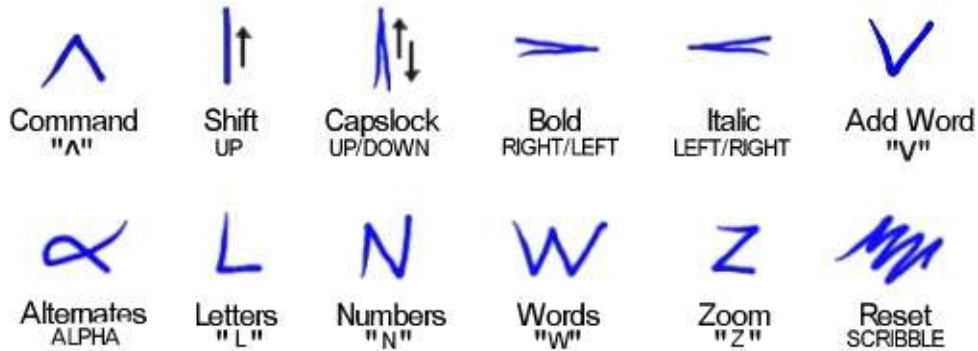
### Punctuation and Special Symbols

Ring-Writer gestures are executed in the space inside the ring. This allows a rapid and seamless transition from pure text input, which is particularly important in the case of punctuation. For symbols not included in the Ring-Writer gesture set, the user will choose a single-character input method (usually on-screen keyboard or character recognizer).



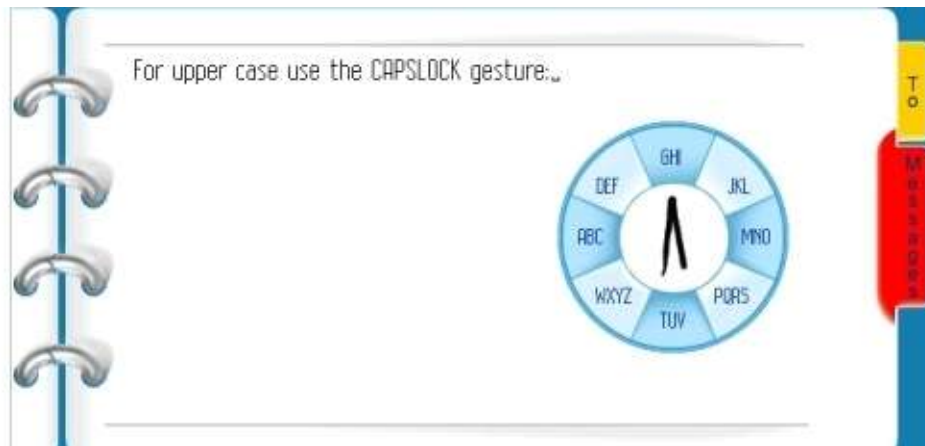
The above diagram shows the symbol gestures defined for the Ring-Writer system. They have been designed to be both intuitive for the user, and easy to recognize. Most of the shapes correspond directly with their written equivalent. Note that it is always a good idea to draw the angles as pointed as possible. Some of the symbols require two gestures, executed in fairly rapid succession. These are: exclamation mark (Down + Tap), colon (Double Tap), semicolon (Tap + Comma), and all of the symbols from the "plus" sign onwards.

## Action Gestures



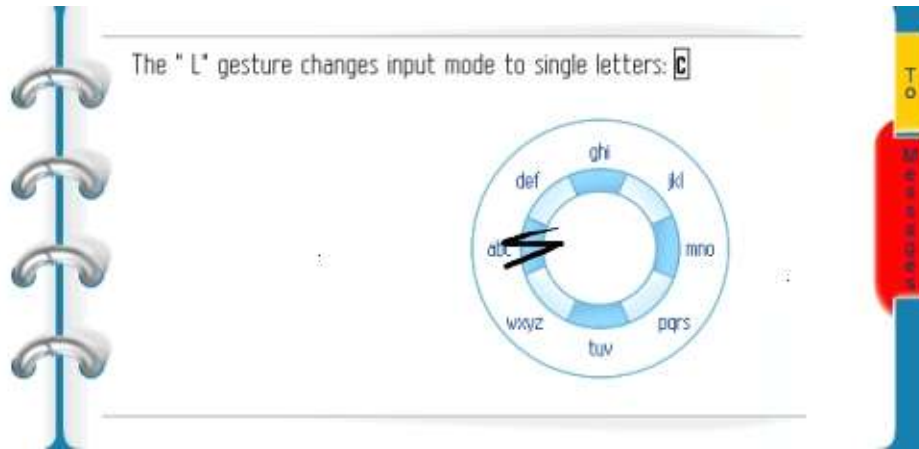
An inverted “V” inside the sector ring introduces a Command. We shall see some examples of commands in the next section. The Reset (or Scribble) gesture, is used to cancel current input, usually following an error in an intermediate stroke. You can also simply cross-out the alternates box (see the section on Editing Gestures).

Four gestures provide shortcuts for defining character style: UP (Shift), UP/DOWN (Capslock), RIGHT/LEFT (Bold), and LEFT/RIGHT (Italic). Executing one of these gestures in the centre of the sectors ring changes the current text input state. The sector letter labels change to show the new state. The following illustration shows the result of a Capslock gesture.



If the user comes across a word that is not in the dictionary, he can enter it letter by letter and add it to the dictionary. The system will allow the user to call up a virtual keyboard for this task, but the sectors ring can also be used to enter single letters. The “L” gesture switches to Letter Mode.

The sector ring changes appearance to indicate letter input. Letters are executed by entering a given letter sector the appropriate number of times (for instance, a line into or through [abc], or a tap in the sector, gives ‘a’. For ‘b’ the sector must be entered twice, and for ‘c’ three times, as shown in the illustration below).

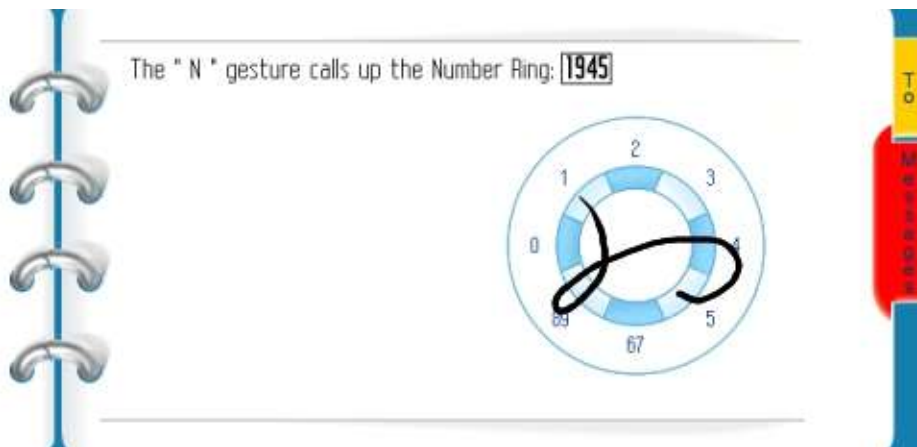


Note that each letter is normally drawn with a single stroke, entering the given sector the appropriate number of times. This means that each letter is naturally separated by pen-up, and there is no reason to introduce an artificial method for separating letters in the same sector, as is common on multi-tap keypad systems (usually by time-out or by defining a specific letter separator key).

*Note that it is not actually necessary to raise the pen between letter if the next letter is in a different sector, although this practice requires the user to take care not to inadvertently re-cross the letter ring in order to get to the next sector..*

When the new word is complete, it can be added to the dictionary by selecting it (see Edit Gestures), and then executing the “Add Word” gesture (“V” shape) in the central area, or by executing the Add Word gesture directly over the word. The “W” gesture can then be used to resume normal word entry.

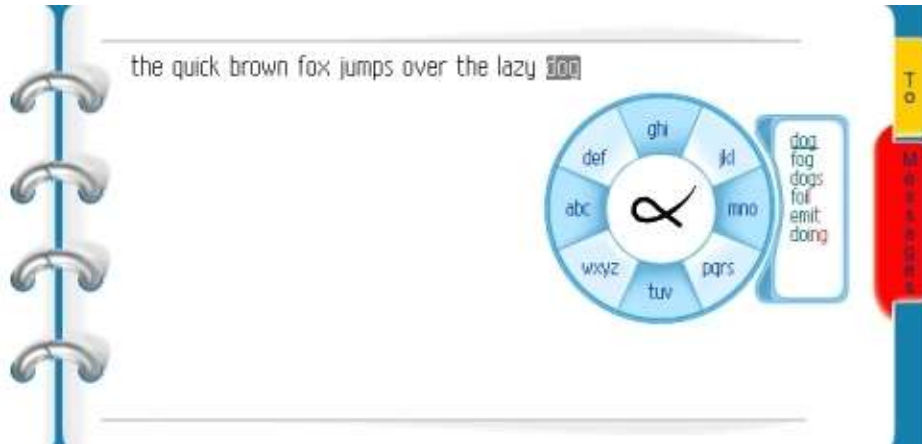
The “N” gesture (drawn starting at lower left) calls up the Numbers Ring:



Again, the user can enter separate numbers by lifting the pen after each number, or (with care) enter a number string in a single stroke. The illustration shows the number “1945” written in one stroke. Note that 6 and 7 share the same sector, as do 8 and 9.

When writing quickly, the user might sometimes accept the proposed word when intending to enter one of the alternates. In this case, rather than deleting the word and

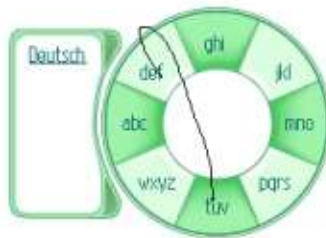
starting again, the user can use the Alternates gesture (an “alpha”) to redisplay the alternates. The gesture can either be drawn directly over the word, or the word can first be selected, and the gesture drawn inside the sector ring. (This second method can be easier if the word is short, or if the font is small). Thus, to change the word “dog” to “fog”, you can select the word “dog”, draw the Alternates gesture in the central area, and then tap on “fog”:



The “Z” gesture is reserved for the Zoom function

### Ring-Writer Commands

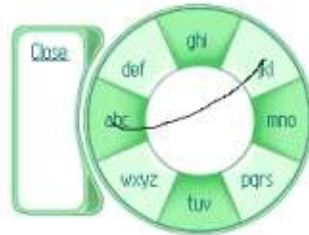
As we saw in the previous section, an inverted “V” inside the sector ring introduces a Command. The sectors change colour to show this fact, and the system will then subsequently propose command names in response to word shapes. This is how Ring-Writer provides functions that are usually menu items in keyboard and mouse systems. The command names proposed depend on the application context. For instance, in many situations, the user will be able to choose the text input language. As an example, let’s see how to change the input language to German:



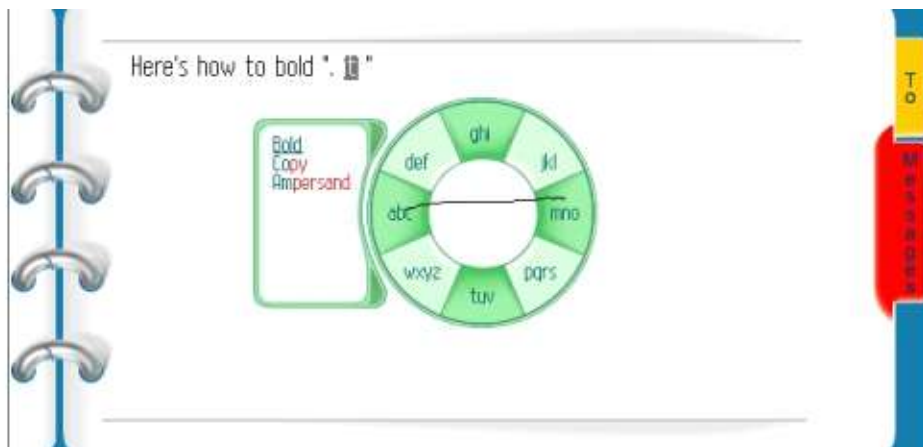
The picture above shows the result of writing “deu” in Command mode. Tap in the centre, or on “Deutsch” to change the current input language to German. The language change is handled directly by the Ring-Writer system. To go back to English, use the command “eng”. Note that it will rarely be necessary to specify more than the first three letters of a command name (and often only one or two letters), since the command “dictionary” will never contain more than a few hundred words.

All of the actions that would be specified as items in pull-down menus in standard

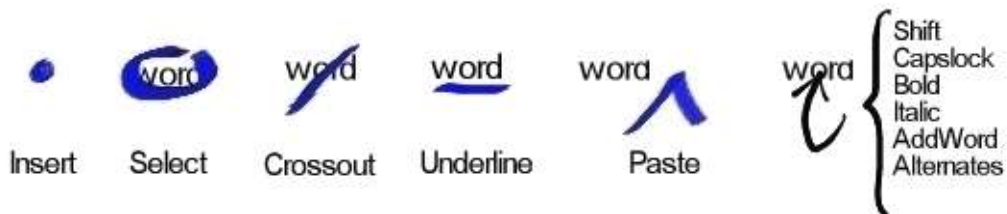
windowing systems, will appear as Ring-Writer commands. Here, for instance, is how to close the application:



During text input, special symbols can be specified by their name. This is an alternative to calling up a symbol keypad in order to enter the symbol, or to using a gesture. Also, all of the action and editing gestures, except the Command gesture itself, have equivalent commands, in case the user forgets a gesture, or has problems with it. Thus, to bold a word, you can first select it, then use the command "Bold". This can be particularly convenient for small words. In the following example, we show how to bold the word "it":



### Edit Gestures



All of the edit gestures can operate directly on the text. The Insert gesture (a tap at the chosen place in the text) sets the position for text input (the cursor position in mouse systems).

The Select gesture consists of a line drawn around a word, or a group of words. (The word group is restricted currently in the demo system to words on the same line). You can also select a line of text, or several lines, by drawing square-bracket shapes round

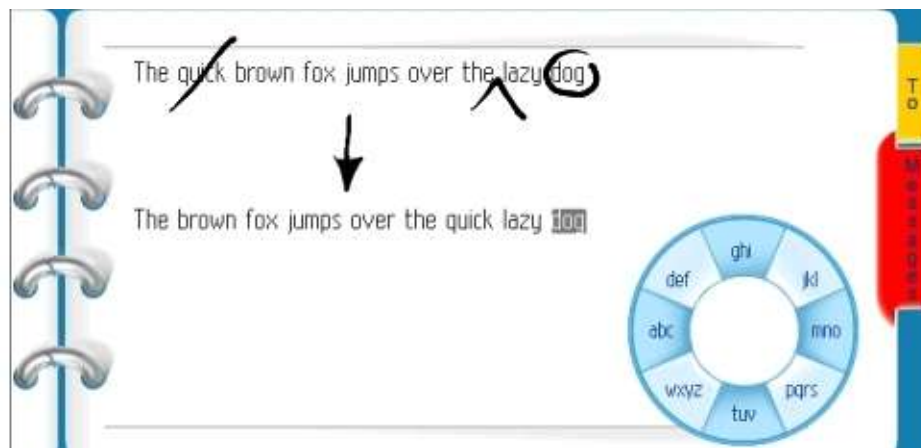
the required text at the extreme right or extreme left of the page.

The Crossout gesture consists of a roughly diagonal line drawn through a word, or a selected phrase. Text removed with Crossout is cut, and can be pasted back into the text area by means of the Paste gesture (an inverted “v” drawn at the new position).

The Underline gesture is perfectly intuitive, and consists of a straight line drawn from left to right, or from right to left, at the base of the word to underline. (The “Underline” command exists for setting the current input state).

You can change the style of a word, or group of words, by selecting, then executing the appropriate gesture inside the sectors ring. Thus, the Shift gesture will change the case of the first letter of a word, Capslock will change a lower-case word to upper-case, and vice versa, while the Bold and Italic gestures will set or unset their respective styles. It is also possible to execute the gesture directly over a word, as long as the gesture stays roughly within the limits of the word boundary. You can also do the “Add Word” and “Alternates” gestures directly over the word.

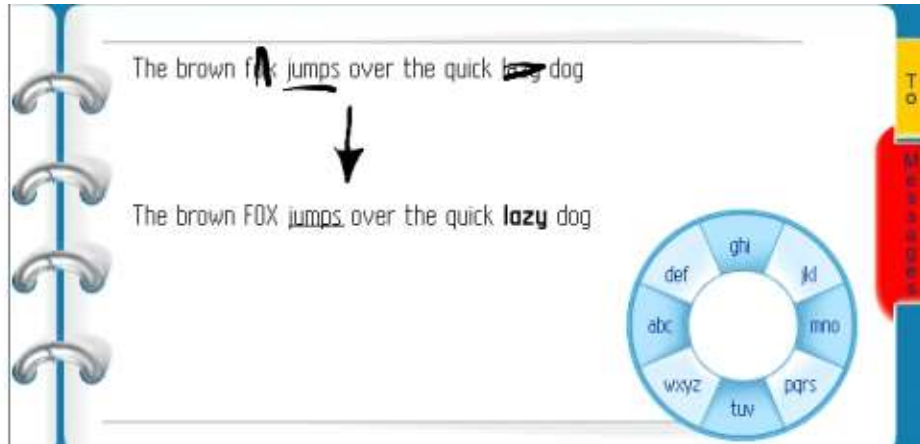
The following illustration shows the main edit gestures in use:



Taking the gestures in order from right to left (which is also the assumed order of execution), we have:

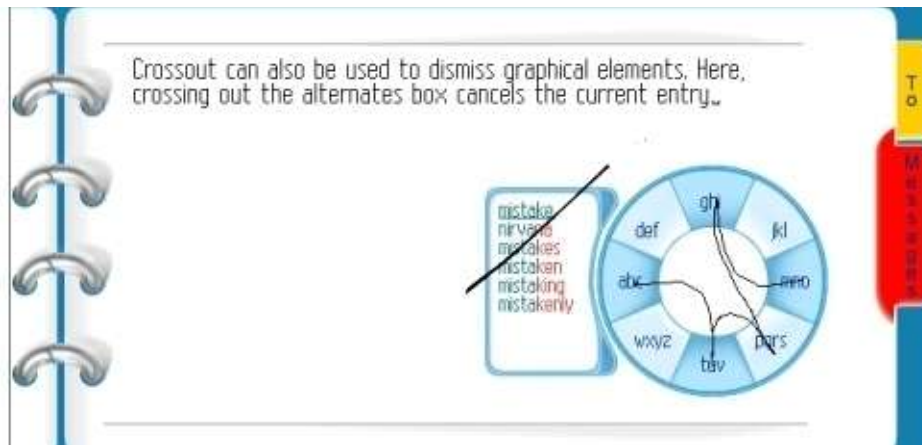
- (1) Crossout “quick”
- (2) Paste “quick” back in front of “lazy”
- (3) Select “dog”

The lower line of text shows the result of this set of gestures. Now, we shall use some formatting gestures to change the appearance of the text:



In the above illustration, the Capslock gesture (UP/DOWN) over “fox” has changed the word to upper-case, “jumps” is now underlined, thanks to the Underline gesture, and “over” is bolded by the Bold gesture (RIGHT/LEFT):

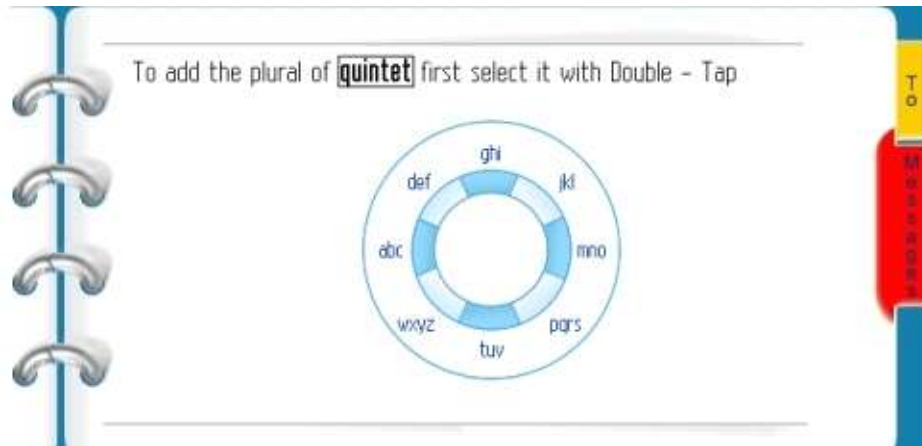
The Crossout gesture is generalized in the Ring-Writer user interface in order to dismiss graphical elements as well as delete text. Thus, in the following example, Crossout is used to abandon the current entry:



### The Double-Tap Gesture

If you tap twice in rapid succession on a word in the text, you select that word for single-letter editing:

This feature can be convenient for making a small change in an existing word in order to add a new word to the dictionary. Some plural forms, or the past tense of rare verbs, may not be present in the dictionary: for instance, the word “quintet” exists in the dictionary, but “quintets” does not.

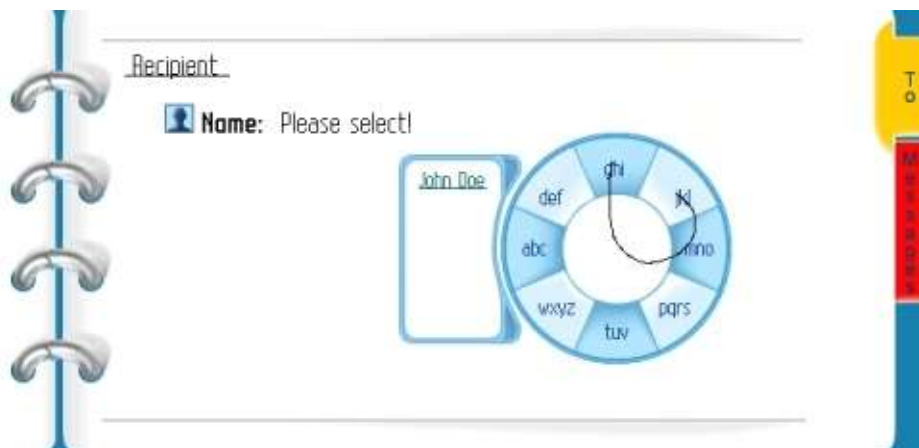


If you want to write “quintets” and then add it to the dictionary, you can proceed as follows:

- 1) Draw word-shape for “quintet”
- 2) Double-Tap on “quintet” to select for letter input (see above illustration).
- 3) Add the letter ‘s’ on the end of the word.
- 4) Use the “V” gesture to add “quintets” to the dictionary.

### The Recipients Page

The Ring-Writer application defines two pages, activated by the coloured tabs on the right of the screen. The Message page is used to prepare the text of an SMS message, or email, as described in the preceding paragraphs. The “To” tab, calls up the Recipients page, used to specify the person to call, or to whom the message should be sent:



On the “To” page the Ring-Writer interface provides an access to the user’s contact list. This is a powerful extension of Ring-Writer, which replaces long list-boxes used in standard Windows interfaces. In the simple example shown above the stroke [abc] [mno] [ghi] is sufficient to unambiguously define the addressee “John Doe” (there are apparently no other “Johns” in the list. Normally, the user will have several hundred

entries in the contacts list, but it will rarely be necessary to use word-shapes traversing more than three sectors. The required entry is chosen in the usual manner, either by a tap in the central area, or by selecting an alternate.



The user can send an SMS by tapping on the mobile phone number shown in the SMS field, call John by tapping on the "Voice" phone number entry, or send an email by tapping on the email address.