

A Better Smartphone Keypad

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1. The need for a better smartphone keypad

The smartphone is poised to become the ultimate wireless pocket computer phone, combining mobile computing power with wireless voice, data and video connectivity, but for one major problem - the arduous task of typing on a 12-button phone keypad designed to enter numbers, not text.

Dozens of articles and papers talk about the need for a faster phone keypad for SMS and smartphone users. Studies abound over the merits of different existing keypad designs, sometimes agonizing over 2 to 3 WPM (word per minute) typing speed differences between them. Manufacturers have tried variations on the 12-button phone keypad, but none have caught on because none were significantly *faster*.

Beyond the simplicity and cost savings of combining a cell phone and wireless computer into a single smartphone device, smartphone options such as built-in cameras, GPS, and voice recorders allow smartphones to go places and do things that our desktops and even our notebook computers never dreamed of. In fact, there isn't much we do with our PC's that we won't do on a smartphone, if it's easy.

Would you send more SMS if you had a better mobile phone keypad?

	Total Votes	Total Votes (%)
Yes	28,313	73.01%
No	7,452	19.22%
I don't know	3,013	7.77%
Totals:	38,778	100%

YES
73%

Source: SMS.ac

2. Typing on a 12-button cell phone keypad

Elephant in the living room.

No one likes to enter text using a 12-button cell phone keypad, they do it because they have to. No one enjoys typing on a cramped, micro-QWERTY keyboard that forces a slightly too-wide smartphone, they do it because they need to type faster. No one buys, maintains, and carries both a cell phone and a PDA by preference, they do it because their mobile phones lack a slim, integrated keypad that affords them the typing speed of their PC keyboard.

Try handing a smartphone with a 12-button keypad to someone who is used to typing on a 100+ button PC keyboard and say: "Here. 12 buttons are good too."

It's a hard sell. No matter how you prop up the existing 12-button cell phone keypad with software, or rearrange its buttons into lines or circles, the 12-button cell phone keypad is fundamentally limited as a text entry device.

PC keyboards offer an average typing speed of **30 WPM** (words per minute) while typing speeds on the 12-button cell phone keypad average a grueling **8 WPM**. That's about 4 times slower than typing on a PC keyboard.

Selling someone on a smartphone with a 12-button keypad is like trying to sell a sports car that only goes 20 mph.

3. Holy Grail

The speed of a PC keyboard in a keypad the size of a matchbook.

The following attributes describe the ideal pocket computer phone keypad:



Easy for the average person to pick up and use for the first time, with no practice or instructions.

Fast like a PC keyboard. **30+** words-per-minute as opposed to the **8** words-per-minute offered by current 12-button cell phone keypads.

Big enough buttons to be easily read, and spaced far enough apart for people with larger hands and fingers.

Small enough to fit into the tiniest smartphones.

Robust with full international punctuation and control character sets.

Single-hand operation - comfortably held and operated with one hand.

Simple and inexpensive to manufacture using well-known components and manufacturing techniques.

4. What's currently available:

Multitap, T9, Micro-QWERTY and Fastap.

"People in the U.S. are not going to spend a lot of time triple-tapping out messages (on a standard phone keypad) -- they just aren't."

- Andy Seybold

Source: **San Francisco Chronicle**
U.S. not getting wireless message
[Henry Norr, Chronicle Staff Writer](#)
Monday, March 18, 2002



Standard 12-button Cell Phone Keypad

"The biggest problem is with actually writing messages. Typing out words on a keypad designed to type numbers quickly is incredibly slow and a major pain. Yes, I know millions of people in Europe and Japan do this but I don't have the patience to learn. Which is a shame, because texting is rather cool and useful. I don't understand why cell phone makers are so attached to the keypad..."

- Andrew Raff

Source: **AndrewRaff.com**
March 19, 2002 12:33 PM

4.1 12-button keypads

Multitap: The venerable 12-button phone keypad like the one seen on the previous page was designed to enter numbers, not letters, and is mis-guided as a text entry device. Anyone who has typed on one of these keypads knows that it requires too much thinking, pausing, and button pushing to enter text quickly. Many people won't even use their cell phone keypad to store names and numbers in their cell phones, much less to type an email. Even with disambiguation algorithms, 5-15 WPM is about as fast as this design can go.

T9: The T9 people did a good job with the hand they were dealt: a 12-button numeric keypad never intended for rapid text entry. While T9 represents an improvement, typing speeds and ease-of-use on T9 still pale in comparison to a PC keyboard. Like multi-tap, T9 uses a totally different keypad layout than QWERTY, has few buttons, and requires constant decision making and extra keystrokes while typing.

4.2 Micro-QWERTY keypads

Rapid typing on handheld devices has been the domain of small QWERTY keypads (a.k.a. "thumbpads") found in devices like the RIM Blackberry and Palm Tungsten, whose keypads offer surprisingly fast (30+ WPM) typing speeds for their diminutive size. Because these keypads use the same QWERTY layout as the PC keyboard, people have no problem locating letters as they type.

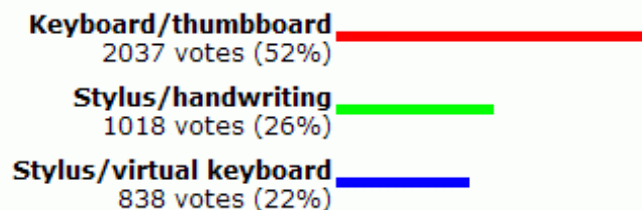
Ideally, we could use the same familiar QWERTY layout in our smartphone keypads, but unfortunately this results either in a phone that is too wide for single-hand operation, or a keypad with tiny buttons that are crowded too close together to read, isolate and press rapidly.

The 2 inch barrier.

Combining a usable QWERTY thumbpad with a smartphone forces the smartphone to be wider than 2 inches, and unfortunately:

1. Phones wider than 2 inches become too wide to hold and operate with one hand.
2. Talking on phones wider than 2 inches looks and feels awkward.
3. Phones wider than 2 inches are not as convenient to carry in one's pocket or purse.

Question: "**Which do you prefer?**" (3893 responses)



Source: www.mobileburn.com



Palm Tungsten

Unfortunately, using a QWERTY thumbpad in a smartphone results either in a smartphone that is too wide ...

Palm Tungsten

"Also, the (Palm Tungsten) unit is just too wide to be a cell phone. It feels awkward and there's just no positives on that front. Yes SMS messaging on a thumbboard rules and I had a great time with it. It still wasn't nearly enough to make up for the rest of the problems."

Source: **MobileMag.com**
Wednesday August 6, 2003 1:26 PM EDT
Reviewed by: [Dave Conabree](#)



Treo 180

Treo 180

"That said, I personally still found the **Treo 180** too wide for holding up to my ear comfortably. I'm accustomed to a much smaller and narrower phone, the Nokia 8290, so the Treo's width felt like holding a small pizza box to my head."

Source: **TidBits.com**
October 14, 2002
Reviewed by: [Jeff Carlson](#)

... or a keypad that is too narrow:



Treo 600

Treo 600

"Among my gripes with the Treo 600: The QWERTY keyboard is so tiny that I couldn't type very fast and kept making errors. I wasn't comfortable writing anything more than a few words in reply to e-mails. A bigger keyboard would be an improvement, but then the unit might become too wide."

Source: **infoimaging**
[forbes.com](#)
Consumer Electronics
New Treo Has Problems, But Also Possibilities
Mike Langberg, 10.30.03, 4:19 PM ET

4.3 Alphabetically ordered keypads with 26+ buttons



Fastap

Alphabetically ordered keypads are typically found in handheld devices such as label makers and calculators.

While easily recognized, alphabetical layouts are surprisingly slow and uncomfortable to type on. (See graphs on pages 8 and 9.)

In his book, *"The Design of Everyday Things"*, user interface expert *Donald A. Norman* states:

"Even though several experiments show that these are of no use to novices and detrimental to experts, every year designers plunge ahead and foist another alphabetical keyboard on us."

Norman concludes:

"Moral: Don't bother with alphabetical keyboards."

Source: **The Design of Everyday Things**

Author: Donald A. Norman

Publisher: Doubleday

5. Motor Memory

It's hard to un-learn something.

Take a moment and try to write your name upside down. It doesn't work. Why is that? Why is writing our name upside down so difficult?

A reflex we have known as **motor memory** helps us learn repeated physical actions such as throwing a ball, writing, typing or tying our shoes. When we perform these learned physical motions, our instincts and reflexes tend to favor our initial training and experiences. Most of us start out typing on a PC keyboard, which basically ruins us for alphabetically ordered keypads because of the difficulty we have 'un-learning' our QWERTY reflexes, and re-learning a totally different keyboard layout.

This difficulty in un-learning and re-training has been observed in disciplines such as skydiving and military training, where performing the appropriate action quickly, the first time and every time, is important.

For example: A PC keyboard user who types on an alphabetically ordered keypad instinctively looks and reaches for the upper left corner of the keypad to type the letter "Q", even though on an alphabetically ordered keypad, the letter "Q" is somewhere near the bottom. This causes users of alphabetical keypads to frequently "stall" when looking for the next letter they want to type.

Motor memory induced stalling not only makes typing on alphabetically ordered keypads uncomfortable, but also degrades user typing speeds on alphabetically ordered keypads to less than half that of the QWERTY layout.

6. The Delta II Keypad

Why it's so fast.

- The **Delta II** speed matrix uses motor memory reflexes to our *advantage*, allowing immediate, comfortable, rapid one or two-handed typing on tiny smartphones and other mobile devices as slim as **1.5 inches** (38 mm) wide.



Delta II Prototype

pat. pend.

www.chicagologic.com

Delta II

The keypad layout seen on the left represents the key to high-speed typing on future smartphones and other small, single-hand operation devices.

"Is your company public? Your product and vision is simple yet brilliant. I would purchase stock in this idea in a heartbeat. I sure hope you are able to convince the industry to see your way."

Source: **Nathan Chase**

Interactive Designer

nathan@eagle-productions.com

Your typing speed depends on the following two time intervals:

1. Target **acquisition** time - the time it takes you to locate (acquire) the next key you want to press (assuming you are not a touch typist on that keypad).
2. Target **activation** time - the time it takes you to move your finger (thumb, stylus, etc.) to that next key and press (activate) it.

These two times added together is the time it takes to perform a "keystroke", which ultimately determines your typing speed in words per minute.

If you are not a touch-typist on a particular keypad, your average target **acquisition** speed mostly determines your typing speed because you spend the majority of each keystroke cycle locating (acquiring) the next button to press. Testing shows **Delta II** target **acquisition** speeds average **twice as fast** as alphabetic layouts, regardless of whether the alphabetic layout is linear, circular, or a matrix.

Delta II breaks the 2 inch barrier.

The **Delta II** keypad matrix keeps every letter in proximity to where it exists on a QWERTY keyboard, but in a slim (less than 2 inch wide), 5-button across keypad suitable for single-hand operation. Raised, semi-elliptical, curved surface buttons with relatively low activation pressure are comfortably isolated and pressed by users with even the largest hands and fingers. In addition to the innate speed advantage of the **Delta II** QWERTY-like matrix, the average distance between any two keys is shorter on a **Delta II** layout compared to a QWERTY layout that uses the same sized buttons and button spacing. The result is faster target **activation** times for the **Delta II** layout vs. the QWERTY layout. This aspect of user interfaces is documented under the subject of: "Fitt's Law".

New users type **twice as fast** on **Delta II** keypads as compared to 26+ button, alphabetically ordered keypads and **four times faster** than their current 12-button cell phone keypads.

The **Delta II** speed matrix is demonstrated at www.chicagologic.com

Instant Speed

Keypad typing speed comparison.

The graphs on the left illustrate typical **new user** typing speeds and improvement rates on four keypad types:

- Delta II keypad.
- Alphabetical 26+ button keypad -e.g. **Fastap***
- **T9*** enhanced cell phone keypad.
- 12-button cell phone keypad using **multi-tap**.

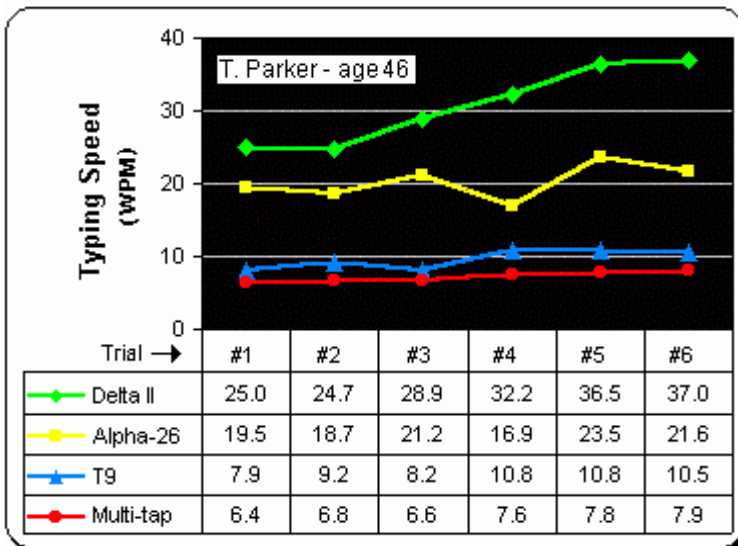
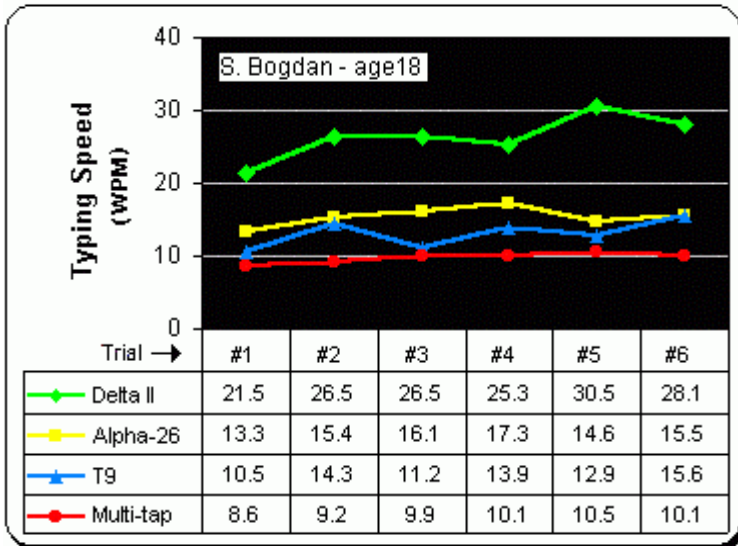
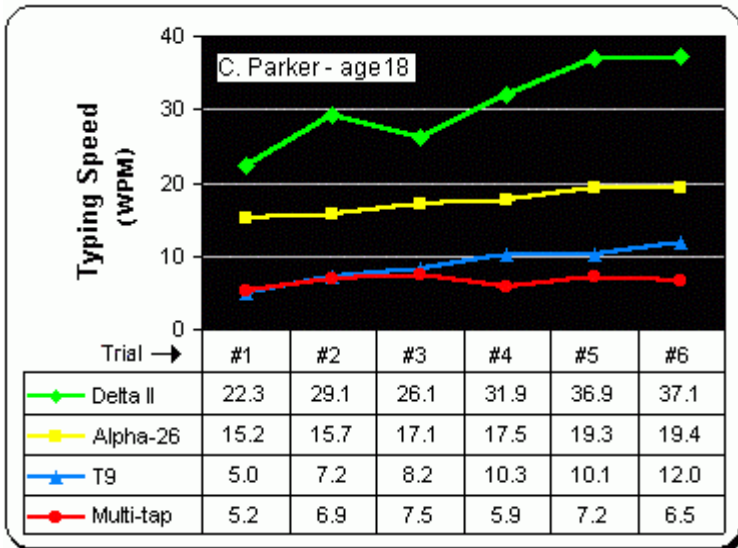
Users were timed while they typed "**the quick brown fox jumps over the lazy dog**", six times into each of the four different keypads.

These times were converted to words per minute (WPM) and graphed by **trials #1 - #6**.

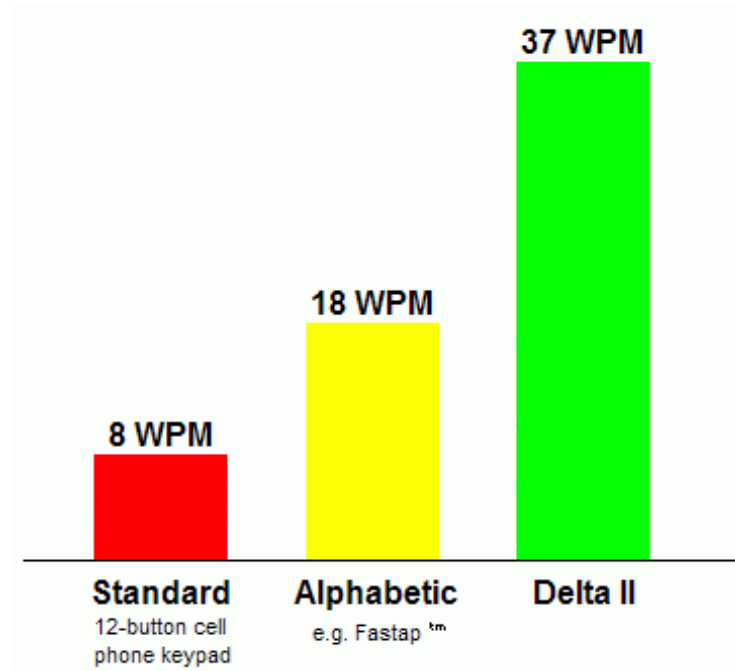
The test subjects were average typists with essentially **no text-entry experience** on any of the four keypad types except for S. Bogdan, who had previous experience with multi-tap.

The results presented here are typical and consistent with those of other users tested.

* trademarks of their respective companies.



Average Typing Speed by Keypad Type



Delta II represents a 300% performance boost in an area where even a 30% improvement would be appreciated - typing text on a cell phone.

7. Dusty Keys™

Smart keypad driver.

Dusty Keys™ is a software option that further accelerates typing by reducing or eliminating the need to use the **shift, period, question mark, apostrophe** and **num** keys during normal typing - example:

You type: **hi tom did the order from sf to lax ship thanks - lisa**

You get: **Hi Tom. Did the order from San Francisco to LAX ship? Thanks - Lisa.**

Delta II overlays the familiar numeric phone matrix on top of the **Delta II** matrix. This means some buttons have both a letter and a number on them, which normally requires a "Num" key to be pressed when the user wants to use a key to enter a digit instead of a letter (see **Delta II** photo on page 7.)

Delta II does have a conventional **Num** button, but **Dusty Keys™** reduces or eliminates the need to use it.

So, if you want to type something like: **see you in 5 minutes.**

Normally, you would need to type: **see you in (Num) y (Num) minutes.**

Note: The number **5** and the letter **y** share the same key - see **Delta II** photo on page 7.

Now there is no need to hit the Num key. **Dusty Keys™** knows when you're typing a number and converts to numeric mode on-the-fly. Remember: The **y** and the **5** are both on the same key:

You type: **see you in y minutes**

You get: **See you in 5 minutes.**

You just saved **two** keystrokes.

Dusty Keys™ is immediately compatible with all current and future software applications because **Dusty Keys™** operates at the keypad driver level.

The **Dusty Keys™** smart keypad driver is demonstrated at www.chicagologic.com

8. Conclusion

The main obstacle to offering PDA and other computer capabilities in a cell phone is the lack of a keypad that is considerably *faster* than existing cell phone keypads - *but no larger*. Currently, all of our choices in keypads are compromises, involving substantial tradeoffs between speed, simplicity, comfort and size.

If you want both wireless voice and pocket computing power, you either carry two devices - a cell phone and a PDA, or choose between the following two compromises:

1. A wider **PDA** type device with a built-in phone and a Micro-QWERTY keypad that offers fast typing, but unfortunately forces a device so wide that it looks and feels awkward to use as a phone, and is too wide to operate with one hand.

or

2. A slimmer **smartphone** that fits nicely in your pocket or purse and can be comfortably held and operated with one hand, but unfortunately, typing on its number-centric 12-button keypad is prohibitively slow.

Solution? Delta II.

People like **Delta II** because it immediately offers them simplicity and comfort in a tiny keypad that is magically fast. This is important because for a new keypad to be accepted, the new keypad must have virtually no learning curve associated with it, must offer an immediate and substantial typing speed improvement, yet must not change the size or form factors of existing flip, folding and candy bar style cell phones.

Delta II is designed and tested from the ground up as a fast, single-hand operation, full alphanumeric keypad that the average person can use, and user testing proves: **Delta II** is by far the easiest and fastest single-hand operation keypad in the world.

Great Standard. Safe Investment.

Delta II is the pocket offspring of the ubiquitous PC (QWERTY) keyboard layout, therefore both layouts will be standards for as long as people choose to type, making **Delta II** a secure investment for everyone, from manufacturers to users.

Delta II - the final piece needed to build a truly competent smartphone.



Two interactive demonstrations are available at: www.chicagologic.com

T9 is a registered trademark of Tegic Communications, Inc.
Fastap is a registered trademark of Digit Wireless.

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