

Split Key

Innovation Days

2/12/2009

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Ubiquity

- Computing revolution
- Productivity gains & access to knowledge
- 2.5 hours of continuous computer use per day in 2007.
-K. Taylor (2007), K. Jacobs (2008)

QWERTY

- Designed 1878 – Christopher Latham Sholes US Pat: 207,559
 - Arranged to slow typists
 - Alternate between left and right hands
- Rectangular layout

~ `	! 1	@ 2	# 3	\$ 4	% 5	^ 6	& 7	* 8	(9) 0	- _	+ =	← Backspace
Tab ⇐⇐⇐ ⇒⇒⇒	Q	W	E	R	T	Y	U	I	O	P	{ [}]	 \ _
Caps Lock ⬆	A	S	D	F	G	H	J	K	L	:	" '	Enter ↵	
Shift ⬆	Z	X	C	V	B	N	M	< ,	> .	? /	Shift ⬆		
Ctrl	Win Key	Alt								Alt	Win Key	Menu	Ctrl

Wrist position

Ulnar deviation



Marklin & Simoneau 2004

Extension



Szeto & Ng 2000

- Can lead to musculoskeletal disorders
 - Carpal tunnel syndrome, hand-wrist tendinitis, etc.

Measures to prevent MSDs:

• Alternate Layouts

- Move commonly used keys to the home row
- Dvorak



• Colemak

<http://stuarthacking.com>

~	!	@	#	\$	%	^	&	*	()	-	+	← Backspace
Tab	Q	W	F	P	G	J	L	U	Y	:	{	}	
← Backspace	A	R	S	T	D	H	N	E	I	O	"	'	Enter
Shift	Z	X	C	V	B	K	M	<	>	?	/	Shift	
Ctrl	Win Key	Alt						Alt Gr	Win Key	Menu	Ctrl		

http://upload.wikimedia.org/wikipedia/commons/8/84/KB_US-Colemak.svg

Measures to prevent MSDs:

- *Shaped*

- Declined and split key surfaces



Kinesis Inc. Maxim



Microsoft Natural Keyboard Elite 4000



Marklin & Simoneau 2004

Measures to prevent MSDs:

- *Split Halves*

Hands to shoulder width

Aligns wrists



Kinesis Inc. Freestyle VIP (right),
Freestyle Ascent (left)

Measures to prevent MSDs:

- *Globe / Other...*

- Many Ideas exist, lack acceptance



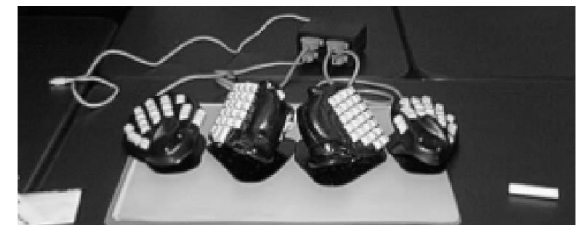
Kinesis Inc. Advantage



Blue Orb, Inc. orbiTouch



<http://www.gateway2at.org/images/altkeyboard7.jpg>



Khalaf 2007

Laptops in 2008

- 38.6 million sold in 2008
- Notebooks > Desktops in Q3 2008
- *Use is increasing...*

iSuppli Applied Market Intelligence

Laptops are PORTABLE!

- Laptop keyboards are often compromised
 - Elimination of the number pad
 - Condensed key spacing
 - Multi-purpose keys
- Ergonomic peripherals make travel difficult
- *Ergonomic laptops?*

Apply ergonomic ideas to a Laptop?

•Previous attempts

- IBM ThinkPad 701C
 - Keyboard expands beyond the laptop case
 - A small form factor with full size keys
- User comfort increased to that of a standard keyboard.



Apply ergonomic ideas to a Laptop?

- *Previous attempts*

- Acer TravelMate 2482
 - Curved keyboard

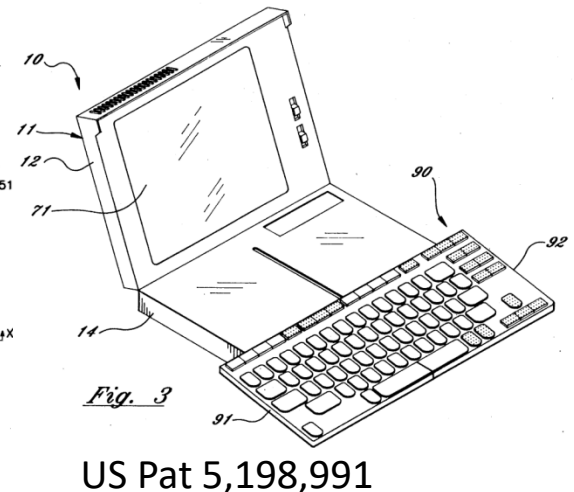
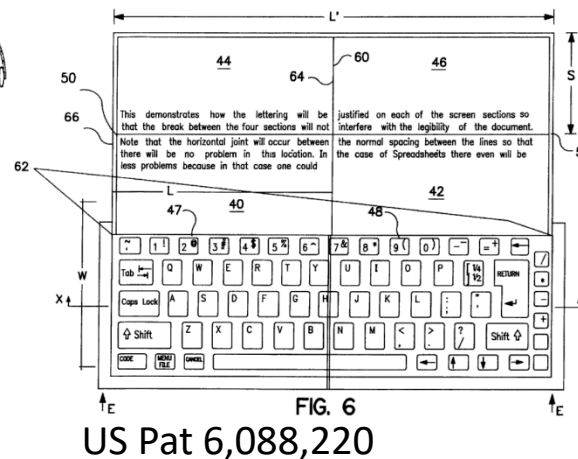
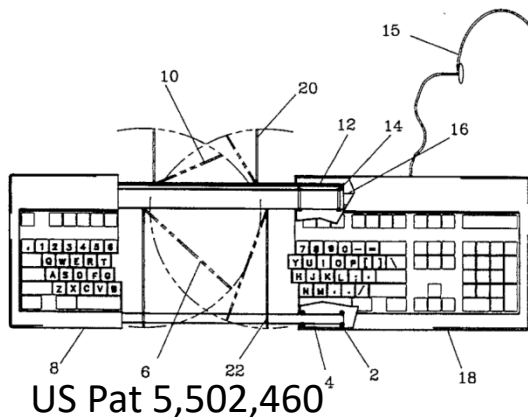


- Little improvement of user comfort

Apply ergonomic ideas to a Laptop?

• Previous Attempts

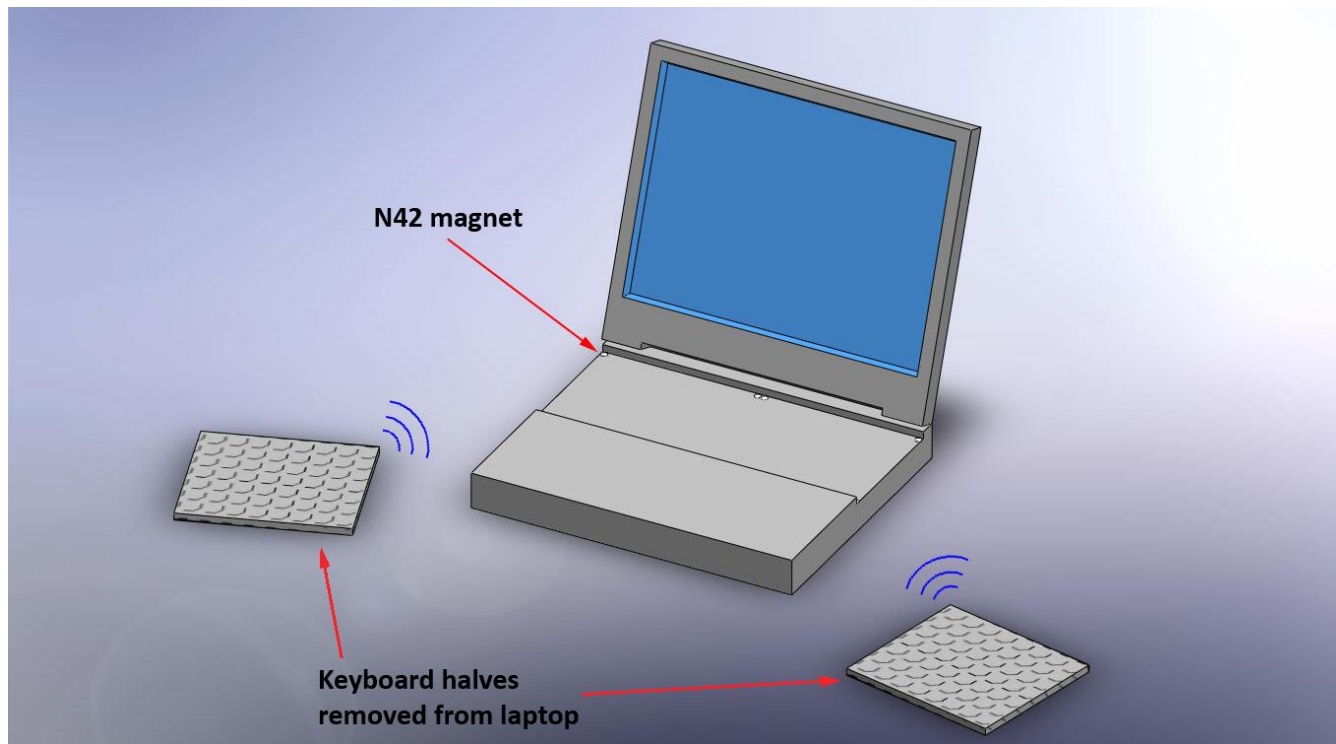
- Many patents exist with this same aim
- Neither the commercial attempts nor patented devices have enjoyed success



- *How to drastically improve usability without sacrificing portability?*

Split Key concept

- Divide a laptop keyboard into independent halves
- Remove halves from laptop body
- Maintain communication through a wired or wireless link
- Retain full laptop function when halves are 'docked'

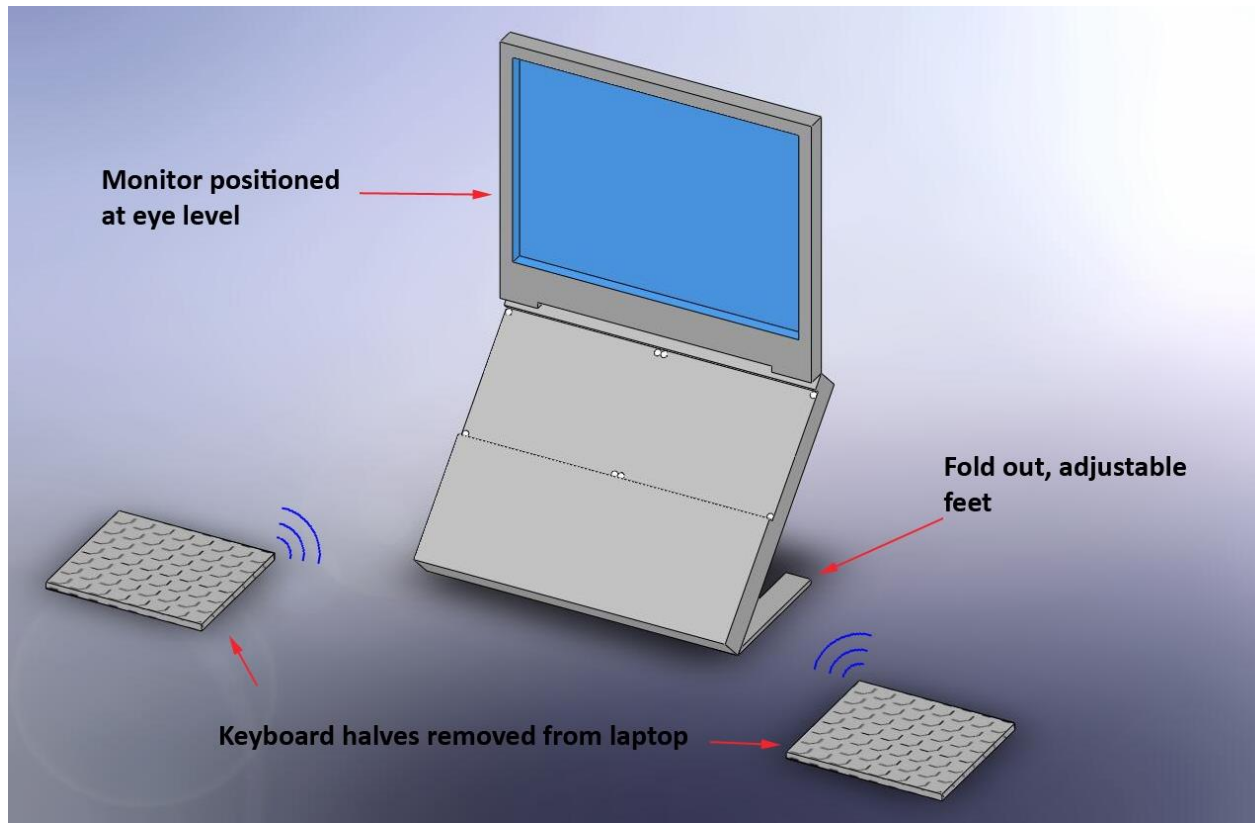


Ergonomic Benefits

- Flexible positioning and orientation
- Allow user to work wherever is comfortable
 - Multiple, ergonomically-equal positions are possible
 - Ability to move between healthy settings during the day
- Similar to shaped and split peripherals
- Comparable reduction in MSD risk

Improve upper body posture

- Addition of fold out supports allow screen height adjustment
- Reduce upper body discomfort



Additional Benefits

- Easy replacement of keyboard halves
- Trying of alternate layouts and languages easy
 - Creation of a laptop keyboard aftermarket?



Production Implications

- *Keyboard construction*

Key top

Scissors mechanism

Compressible dome



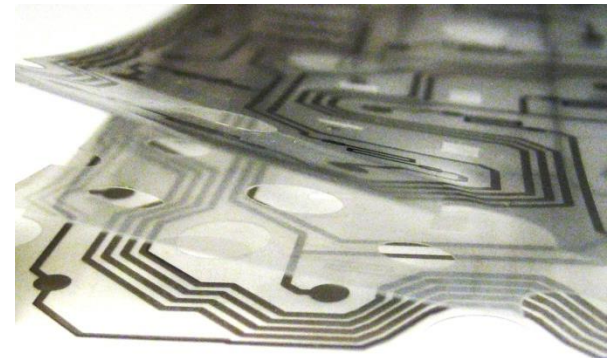
Top conductive trace

Separator

Bottom conductive trace

Structural backing

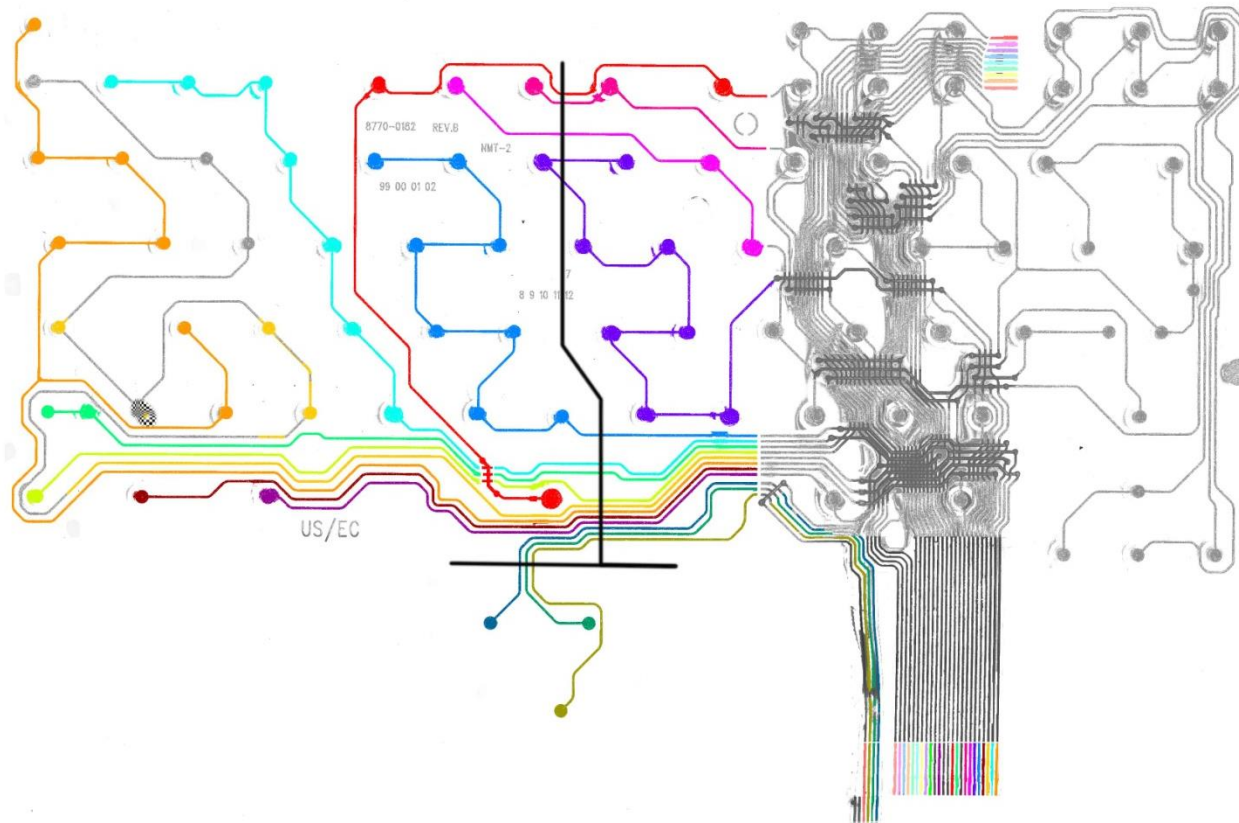
(not shown)



Production Implications

- *Wired*

- Multiconductor wire extends the keyboard connector
- Key matrix converted to a standard (PS2, USB, etc.)



Production Implications

- *Wireless*

- Wireless transmitter using Bluetooth, IR, etc.
 - Bluetooth is common to many new computers



- Powered by a rechargeable battery
 - Charging contacts in keyboard depression

Laptop Production

- Recognizable brands contract with component manufacturers
- Raw component pricing information is not public
- Keyboards are not upgradeable



Keyboard Pricing

- Public replacement keyboard average price
 - \$26.66
- One Laptop Per Child keyboard - *\$100 laptop project*
 - Contains a **5-10%** keyboard markup to entice manufacturers
- Assuming a 10% manufacturer markup and a 30% reseller markup, a laptop keyboard costs:

\$16.72

Split Key Improvement Cost

- Wired:
 - New attachment means: magnets - \$0.80
 - Multiconductor wire, 2 x 15" long - \$2.45
 - total notebook cost = **\$19.97**
- Wireless:
 - New attachment means: magnets - \$0.80
 - Two Bluetooth transmitters - \$6.38
 - = **\$23.90**

What are consumers willing to pay?

- Survey standard, wireless, and ergonomic keyboard prices
- Assume keyboard price related to perceived value
- Compare the average cost between keyboard types
 - Percent difference indicates the acceptable cost increase

This ignores many factors in a keyboard purchase and is used here for lack of actual data

What are consumers willing to pay?

- Newegg, Inc. (242 samples)
 - Standard to ergonomic: 151% → **\$25.25**
 - Standard to wireless ergonomic: 475% → **\$79.42**
- CDW, Inc. (395 samples)
 - Standard to ergonomic: 94% → \$15.72
 - May be biased - 27 standard keyboards to 1 ergonomic
 - Standard to wireless ergonomic: 133% → **\$22.24**



Recall Split Key wired: \$19.97, wireless: \$23.90

Survey conducted on 1/20/2009

~~Ben's Laptop Sales?~~ Patent Protection

- Computer and computer component market is crowded
- Split Key is not a decisive selling feature
 - Size and performance primary drivers in computer purchase
 - Could be an optional upgrade with informed case design
- Patent protection

Revenue Projections

- 38.6 million laptops sold worldwide in 2008 – iSuppli
- 1 % initial market adoption (386,000 units)
- 1 % license fee for each keyboard sold
- Wired: \$77,000 /year
- Wireless: \$92,200 /year
- Patent protection in US and leading markets
 - Pursuant to the Patent Cooperation Treaty
 - ~\$100,000 or WARF

Thank you

- Questions?

