The Role of Physical Impedance Matching in Music Playing

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Dare to be naïve.

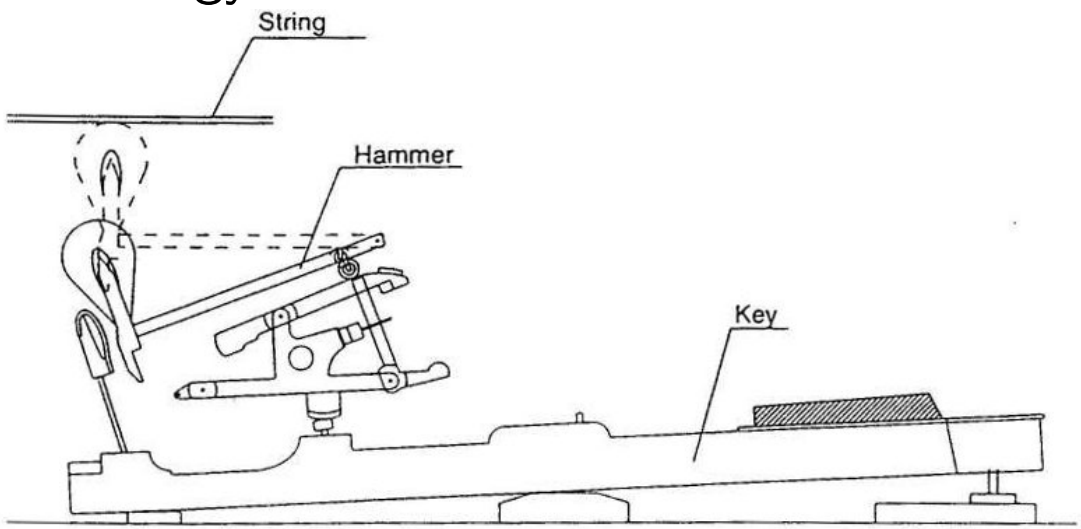
R.Buckminster Fuller

Why some work and some don't?

- Why some musical instruments are successful and others are not?
- How is it that some of them contribute greatly to the history of music, while others are quickly forgotten as "interesting experiments"?
- Before conjecturing, a few examples...

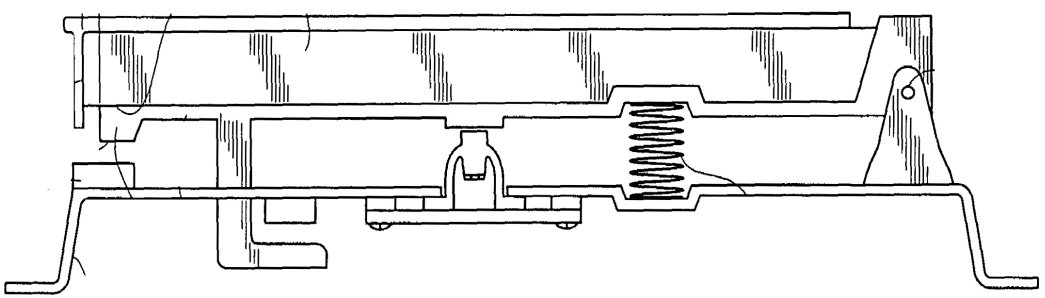
Piano vs. other keyboards (1)

- The piano is the most obvious example: a complicated technology...



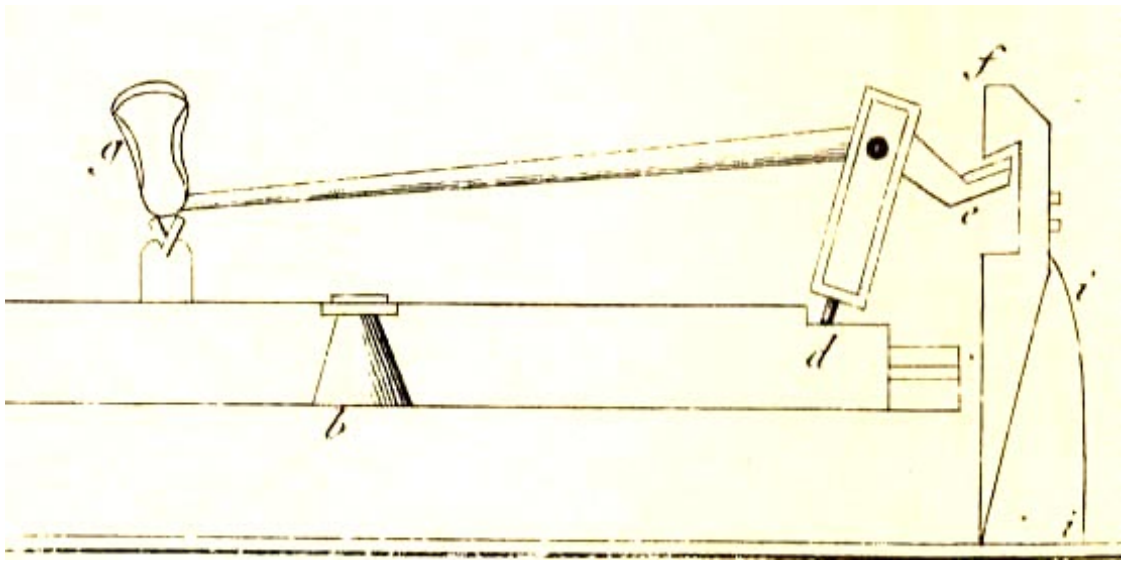
Piano vs. other keyboards (2)

- . . . versus simpler (albeit functional) mechanical structures of cheaper keyboards. . .



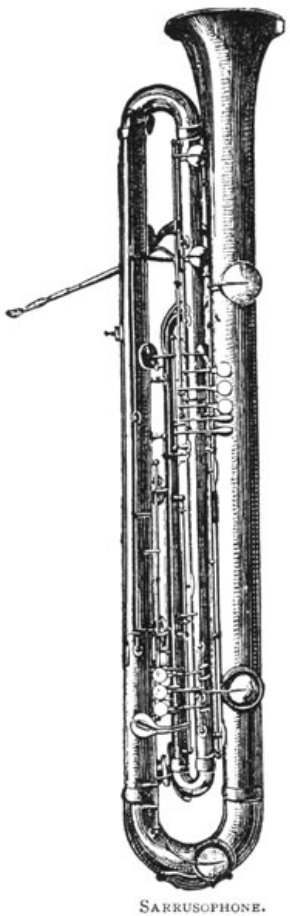
Piano vs. other keyboards (3)

- . . . or, for that matter, of fortepianos and/or clavichords



- the success of the piano cannot be solely ascribed to its better fitting social function

Saxophone vs. Sarrusophone (1)



- Adolphe Sax was convinced that his invention would be less successful than that of his friend Sarrus
- Single–reed vs. double–reed

Saxophone vs. Sarrusophone (2)

- Little did he know that "jazz" was about to become one of the most successful music universes of the twentieth century, opening the path of success for the Saxophone

- Again, the success of this instrument cannot be ascribed solely to purely functional reasons (otherwise the Sarrusophone would have made it too)

Alphanumeric Keyboards (1)

- Now for a funny (but fitting example): typewriters vs. computer keyboards

Alphanumeric Keyboards (2)

- Old style mechanical typewriters have often been (ab)used by music composers in many contemporary music works (Cornelius Cardew *Scratch Orchestra*, for ex.)
- That is: they considered the typewriter *playable*, and the emitted sound results *musical*

Alphanumeric Keyboards (3)

- Today everybody plays in a laptop orchestra...

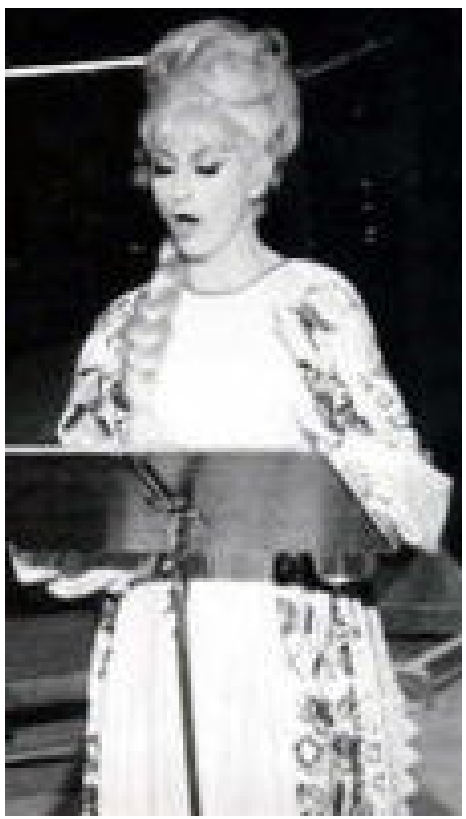
- ...but we all know that the computer keyboard is very limited in its musical expression

More funny combinations...

Successful	Problematic
synthesizer 	theremin 
percussion 	glass harmonica 
turntables 	tangible interfaces 
...	...

Finally: the voice (1)

- Of course, the voice by itself is known to be a wonderful musical instrument



Finally: the voice (2)

- But what is so musical in the voice...
- ...that cannot be found, say, in our hands?

So?

- All these examples (and many more can be found), outline *one* essential issue:

  Haptic interaction per se is not a sufficient explanation for the musicality of an instrument

The Conjecture (1)

Proper physical impedance matching is what actually makes the difference between a successful musical instrument and a non–successful one.

The Conjecture (2)

- The impedance of the instrument must be tuned to the capability of the physiology of the specific body part or parts that are involved in playing it (fingers, lips, arms, mouth, etc.)
- The result is the ability to learn to be extremely fast and precise in playing by calibrating the exact balance of forces required by the performance

The Conjecture (3)

- Possibly, these "regions of matching" behave in a more or less linear way, while their boundaries become substantially non-linear
- And it is precisely this non-linearity that makes up for an "extra" expressive touch in many cases (think of "over-blowing" or "flautando" playing, for example)

Conclusion

- Proper *impedance matching* (which seems to be also a more general basis for enaction) between local human physiology and musical instruments is possibly a good motivation behind the success of musical instruments
- How to study these "mapping areas"? Can a synthesis–from–analysis method be devised?
- Please note: in contrast with all the trends in interface design and HCI, musical instruments are hardly designed to be "friendly"; rather, they are designed to achieve the best fit with a highly skilled human physiology