



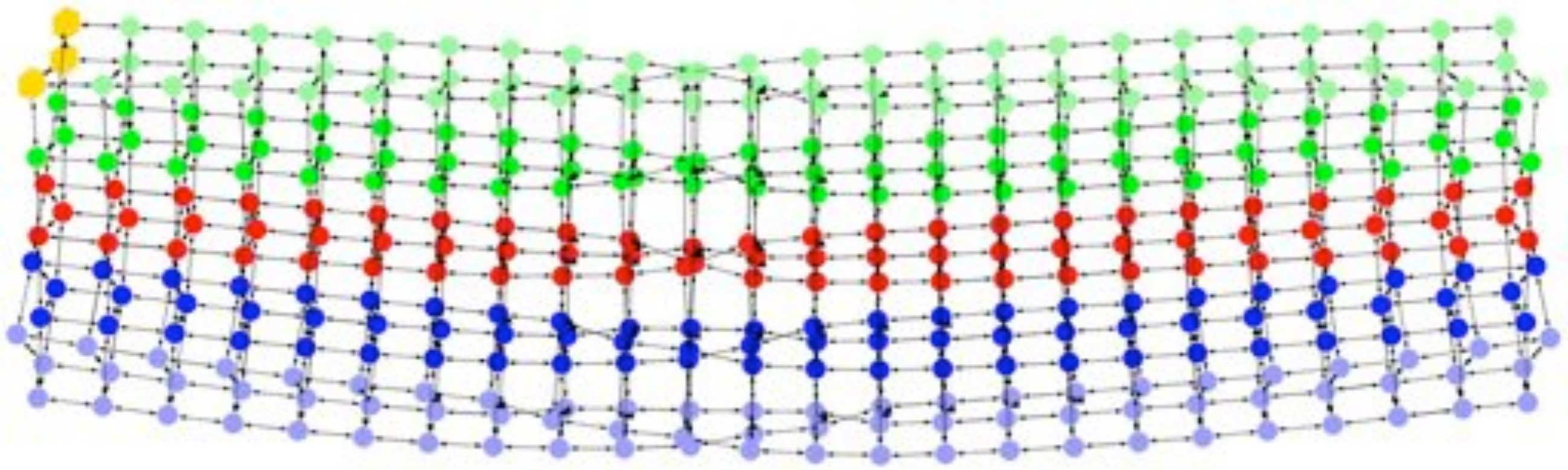


Real invention c.1755









Not just content

- Architecture
- Programming
- Hardware
- Comms



April 27, 2008
Graseby 3400 — initial notes

- At any stage before an infusion has started, it is possible to change the units after entering a dose. A nurse can even change units while entering a number: for example, by pressing [1][5][0][2][5] would change the units half way through entering the number 12. However, changing from ml/h to mg/kg/h would not work. For example, entering [5][0][5] then showing the units ml/h, the nurse can press [2] to change the units to mg/kg/h (converting) multiplies the current dose by 100, changing from ml/h to mg/kg/h divides the given dose by 100. Or a nurse pressing [1][2] when in ml/h units, then changing at the units display the displayed number to 0.12, and then pressing [2] to change the units to mg/kg/h, the displayed number is 12.
- Once an infusion has started, the units can only be changed if the infusion is stopped, switching the pump off, then on again.
- When an infusion has started, a nurse cannot review or change the units in original units, body weight, concentration, but can review mg/h etc (and the total dose delivered if [2][5][5]).
- If the nurse has pressed [2][5][5] after showing units, it changes the units unless they enter all data. For example, as units, the device will ask for the weight (in kg) then a nurse can choose mg/ml or µg/ml. The only ways to exit is to switch the device off and on again.
- Once [2][5][5] is pressed after entering a dose, the device shows in any way the currently chosen units of dose. (This space to confirm the syringe type, which the nurse can see on the syringe site on top of the device.)
- If the nurse presses while entering a dose it can be entered single, entering [5][0][5] would be treated as 0.0 (such as a beep or change in the display) that a timeout over, entering 0.0 gets those beeps, as if all three buttons recognized, whereas entering 0 alone would have got only one beep.
- If an incorrect dose is entered, the pump will still say "0" even though pressing [2][5][5] will achieve nothing. However, or blocked as they are entered. When [2][5][5] is pressed, "low" when, in fact, the body mass entered was out of range.
- If the pump is infusing, the nurse can change the rate. They then enter a number (only in the original units, not mg/h etc) and press [2][5][5].

*Units are set using a softkey, so it is not always possible to change a displayed unit to infuse units.



depending on what the nurse has specified. The rate is remembered from one bolus to another but the dose is not — it is set to zero.

- The manual repeatedly mentions the pump's 'configurable numbers'—explained.
- Instructions for setting the basic flow below are incorrect some weird types, which make nonsense of their instructions.
- The bolus interaction often says PRESS AGAIN but it says to press again, or why. Sometimes it says PRESS AGAIN button to press in [2][5][5] but it does nothing because the deliver dose, which is always reset to 0 after a bolus (a not certain).
- If the nurse presses [2][5][5] when the pump is not infusing (apparently instructed) flashes a screen up so quickly it can't be seen to the top level screen, possibly after taking the settings of the dose (which are irrelevant if only a bolus review settings is asked after [2][5][5] is pressed if not all is viewed since the pump was switched on). In fact, the nurse must press very quickly and it is not clear if it is possible to press [2][5][5] when the pump is not infusing.
- After pressing [2][5][5] the nurse must enter a dose and a unit in either order. The device screen shows both numbers or checked easily. The units of the dose (e.g., mg/kg/h) are not instead they depend on the main dose units as follows:

Dose	Before dose	Before rate
ml/h	ml	ml/h
mg/kg/h	mg/kg	mg/h
µg/kg/min	µg/kg	µg/h
mg/kg/min	mg/kg	mg/h
mg/h	mg	mg/h
µg/h	µg	µg/h

The infusion screen obvious enough when it is written do be changed easily? To change the dose units, the nurse is though nothing has started, then change units, then p they can wait approximately 5 seconds for a timeout, then press [2][5][5].

- Sometimes setting a bolus gets the display PRESS AGAIN is pressed again the display REVIEW SETTINGS. If the nurse and then presses [2][5][5] again it will still say REVIEW SETTING means review the settings, it means change them.

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to change body weight or concentration). There is a soft key to confirm the new number, indeed, [2][5][5] must be pressed. If they do not press [2][5][5] in 5 seconds, the changed number reverts to the original. In contrast, when entering a dose rate when the pump is not infusing, to modify the rate, the nurse should press [2][5][5], and there is no timeout.

- If the pump is on but not infusing, after approximately 100 seconds it will keep regularly and flash on its display that it is NOT INFUSING, means error? Yes, yes, even if the currently set dose is zero or out of range.

Although most buttons on the syringe pump are about 10 do nothing, whenever a number can be entered, all screen lines, even when they do not work. Thus, trying to enter give feedback that sounds like all those buttons [2][5][5] pressed, but the change actually entered will be zero in if the pump will allow the nurse to enter a dose up to 999 though it is an error to have a rate higher than 999 calculated from body weight and drug concentration so as to detect a dose error before the interaction is complete ask the user to press [2][5][5] when in principle it is known as because the dose is out of range.

- Pressing a digit by accident then [2][5][5] does not cause reverts the dose to zero.
- Number entry is quite different from number entry on a such as a calculator — even though the manual says the do to "maintain ease of setting up." For example, just by 10 some cannot tell whether the next digit pressed would be one hundredth position of the number. For example, display shows 1.2 would change the display to 1.20 or 1.20 display shows 1.00 would change the display to 1.00 or 1.00. At least in a conventional calculator, the user can tell the go in the least significant position (but if the number displayed won't know whether another digit will go in the units or in pressing [2][5][5] would make either 0.0 or 0.0).

When entering a dose, the nurse can view the total dose it (always in ml), the nurse presses the soft key [2][5][5], and along with [2][5][5] which reverts the total to 0.0 (even if the soft key [2][5][5] remains displayed, even though it does the total is displayed). There is no way out of this mode even though the soft button [2][5][5] remains — it does not disappear. After a timeout, the pump does not revert to 0 mode it was in, instead it goes to the top level.

- A nurse can leave the 2526 mode before 5 seconds by p the infusion dose is needed. (The 2526 mode can also be through this might be because a bolus takes longer than 5

*In the USA, the maximum for the Graseby 3400 is 1200ml/h. See 3400 (Chatterjee) Pharmacological Dose Setting, US CME/CE/ACCME 2008 - 300 (finding website at www.medcentral.com).

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- There is no way to leave the total dose mode except by doing nothing for 5 seconds. Attempting to do anything, say pressing the [2][5][5] button, merely delays the timeout!

If a nurse wants to know or check the total, I think it unlikely 5 seconds is long enough to read it.

- In the 2526 mode, the soft key [2][5][5] remains displayed but does nothing.

If an infusion has started, the user can press [2][5][5] to change a dose rate or set up using even different units, once at must be entered in ml/h units only. The device strictly not rate and the new rate as it is entered. The nurse can the new rate, if they do not, there is a five second time a rate to the current rate.

- The pump has numbers entered in various modes, dose, review, as required by the units chosen. Changing reverts to µg/ml for example) before exactly like changing on number, except when changing the dose rate of a running but entry is usually but not entirely consistent with the consistent with other Graseby? other medical devices?

If an infusion has started, the nurse can change the rate key [2][5][5]. A small display now shows the current of the nurse presses digits, the NEW RATE number changes 0. However, if the nurse now presses [2][5][5] it reverts the change it. To change the rate, the nurse must press [2][5][5] if the user does not press [2][5][5], there is a 5 second time a used.

Why is the soft key [2][5][5] still shown, when what it does Change does not allow the weight or concentration to be the infusion must be stopped and then restarted.

- The manual mentions the pump can be purged (p. 12) of the infusion however.

The manual gives two ways of doing a bolus. Neither need pump must have started an infusion. (A bolus would be the calculate, though there is no way to set the drug rate without writing it down: i.e., write down total, bolus, or previous value.)

- Section 5 of the manual has the sentence, "The bolus p8 3400 syringe 3000ml/h, using a 100 3400 syringe must pressing the ENTER screen key." This is nonsense!

The illustration in Section 5 is wrong. What is shown is



*Graseby 3400 manual dated 2004, paragraph 100.

- If the nurse does a bolus during an infusion, the interaction is as described above, except that the infusion continues at the end of the bolus. However, if the nurse stops the bolus, the infusion is stopped as well.

The manual warns, "Before confirming any displayed data the user should review that it is correct. Failure to do so may result in compromised function of the product, patient injury or user injury." There is no consistent way to do this, and if the user presses [2][5][5] or a digit, when trying to do a review, then the values will change (and generally cannot be restored).

- Generally buttons only beep when they do something, except: digits and the decimal point beep even when they do not change the displayed number, and will keep beep whenever they have a soft label, even if they do nothing (e.g., the first press of [2][5][5] gives the total, and new subsequent presses do nothing, but they still beep).

The manual does not say which mode numbers it refers to. Various details (e.g., in screen layout) — for example, both modes are shown in the manual as "FALSI 06 4" (reversed) but in fact they appear as "FIRST DISE 06" (all justified) suggest the pump has been modified since the manual was written (or the manual is just sloppy).

- The 2526 mode has various values and they do not beep or otherwise warn the user of their action. This could well be a problem for a distracted nurse.

It appears that it is not possible to infuse unless all relevant numbers have been reviewed (i.e., shown on screen) — whether or not the nurse actually reviews them is another matter, also the review process allows numbers to be changed, which may be a good or bad thing, either reversing or introducing errors). Similarly it appears that it is not possible to do a bolus without entering some dose (even the dose seems to reset to zero).

These are both good safety properties, but the manual does not mention them.

- There is no mode button of any sort.
- There is no 'back key' (e.g., of total drug mode). One would be useful if the nurse changes the total, or dose a pump, etc.





MUTE button - Press to silence alarm for (approximately) 2 minutes. The alarm will resound after this time.



PRIME/BOLUS button For future implementation.



OPTION button For future implementation.



PRESSURE button For future implementation.



CHEVRON keys - Double or single for faster / slower increase / decrease of values shown on display.



BLANK SOFTKEYS - Use in conjunction with the prompts shown on the display.

What to do?

Enter 1.2 mL/h



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1. Ennovation
 2. Principles and analysis
 3. Design tools
 4. Machine learning
 5. Story telling



Ennovation?

Percentage of single-press errors that can be undone directly: 8.08%

- *If a button is pressed by mistake, how often can you get back (undo the error) in just one step? If the device has an undo key, this figure would be 100%*

Average cost of an overrun error: 0.2

- *If the correct button is accidentally pressed twice (not once), how hard is it to get back (undo the overrun error)? If the device has an undo key, this figure would be at most 1; if the device was idempotent (when a button gets the device to a state, it keeps you there), the figure would be 0 because you couldn't make overrun errors.*

Average cost of non-trivial overrun errors: 2.77

- *If the correct button is accidentally pressed twice (not once) and it does something, how hard is it to get back (undo the overrun error)?*

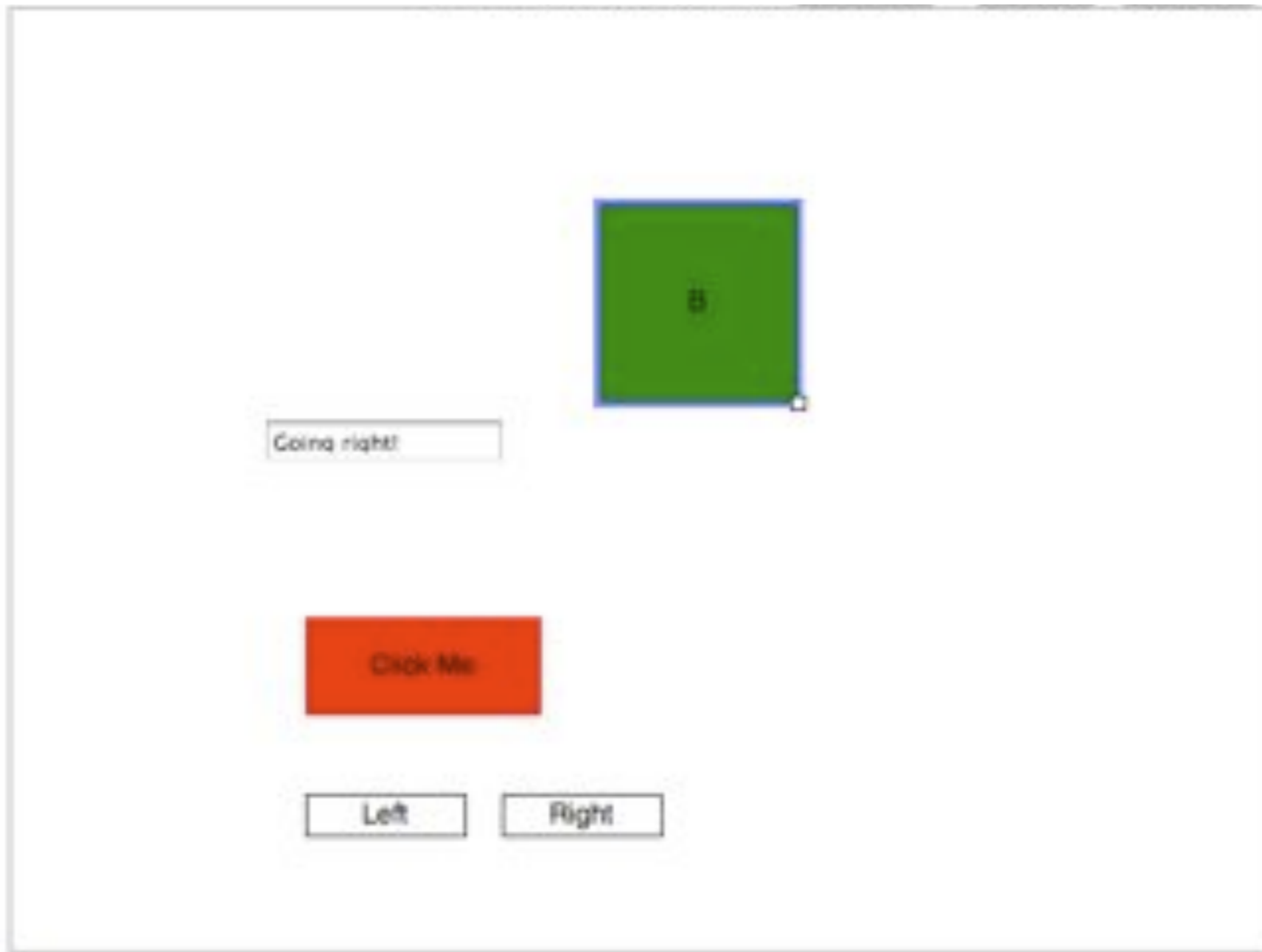
Worst case overrun error cost: 5

- *If an overrun error occurs, what is the worst cost of recovering?*

Average cost of a restart recovery for overrun error: 5.79

- *If the correct button is accidentally pressed twice (not once), how hard is it to get back (undo the overrun error) if the user switches the device off first to restart it?*

Principles?



DIY data collection

Tools?

```
build(  
  ["mouseup", "mouseover"], [a, b, c],  
  ["color", "visible"], [state]  
);
```

Directions...

- Open source
- Wikify
- Animation



Machine learning?





Love vs Chocolate, 18 June 2008

2 “digital stories”



Swansea digital storytelling centre...

Summary...

1. Ennovation
2. Principles and analysis
3. Design tools
4. Machine learning
5. Story telling

