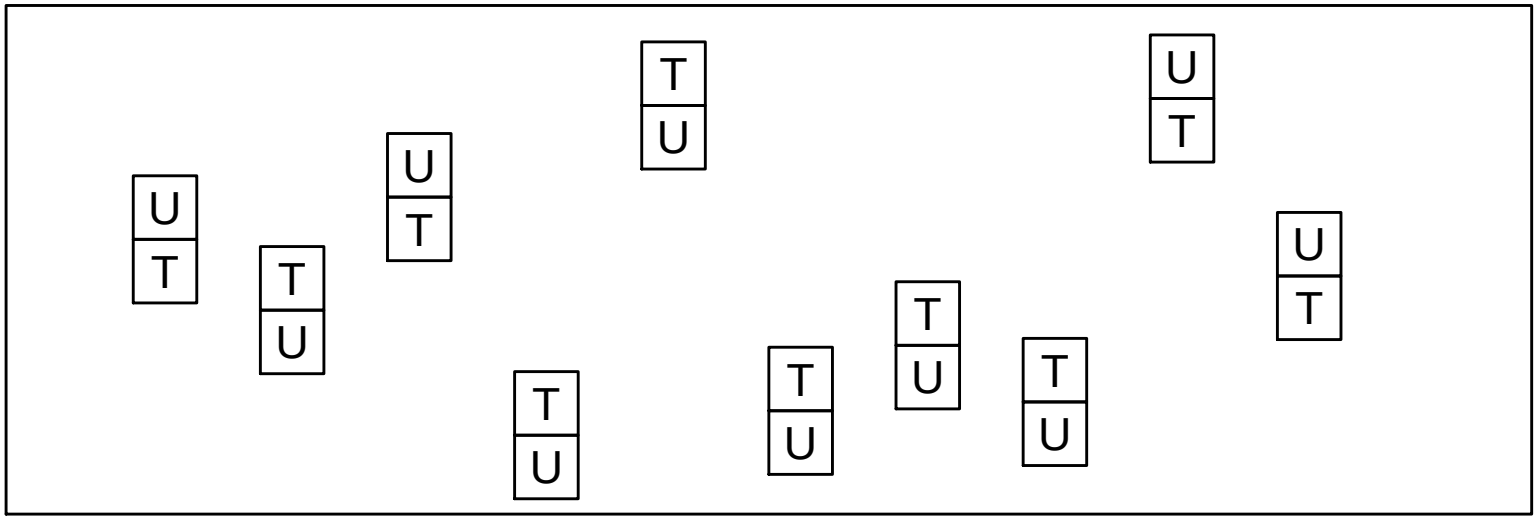
A paired experiment

Objective
How effective is a chemical treatment in increasing the abrasion resistance of rubber?

The experimental design

- **ten test-pieces cut from a sheet of rubber;**
- **each piece cut in half**
  - **one half of each piece chosen at random to receive treatment**
  - **other half of each piece does not receive treatment**
- **abrasion resistance measured for each of the 20 half-pieces.**

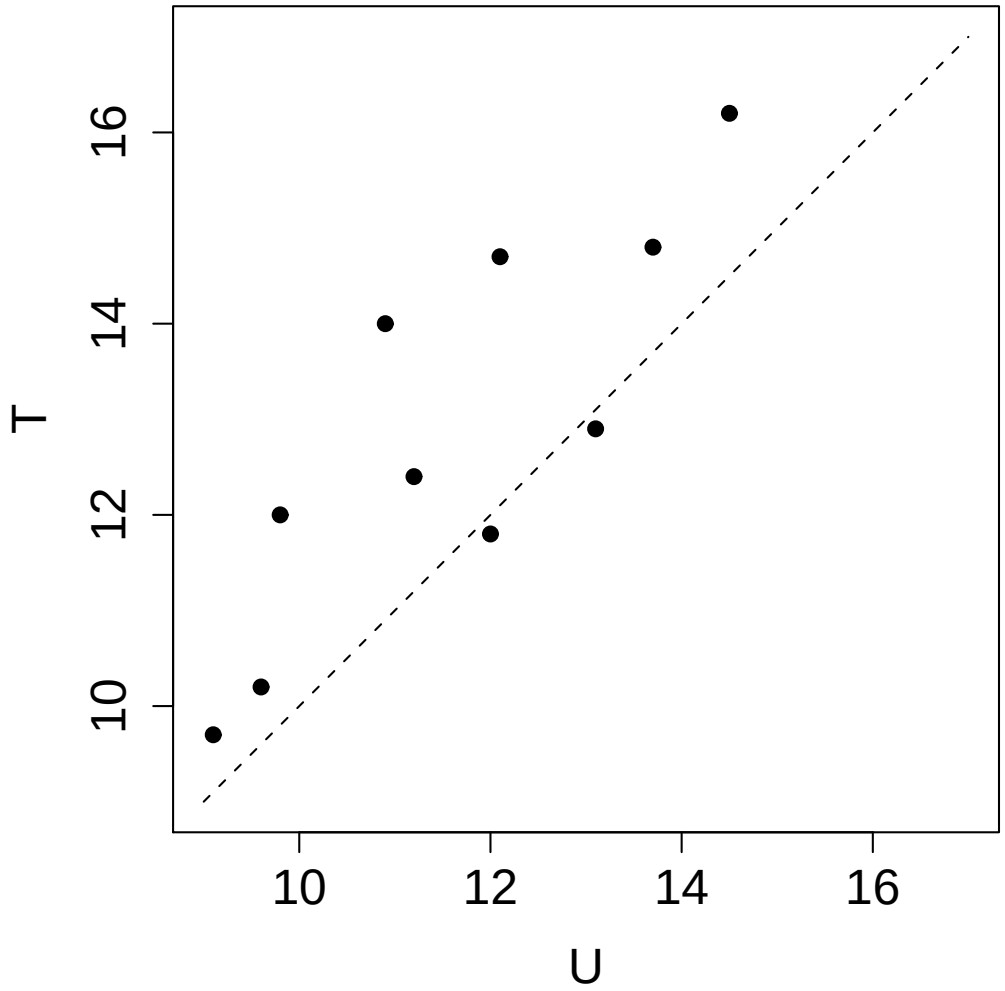
A schematic of the experimental design



Resulting data

Piece	Untreated	Treated
1	12.1	14.7
2	10.9	14.0
3	13.1	12.9
4	14.5	16.2
5	9.6	10.2
6	11.2	12.4
7	9.8	12.0
8	13.7	14.8
9	12.0	11.8
10	9.1	9.7
Average	11.6	12.9

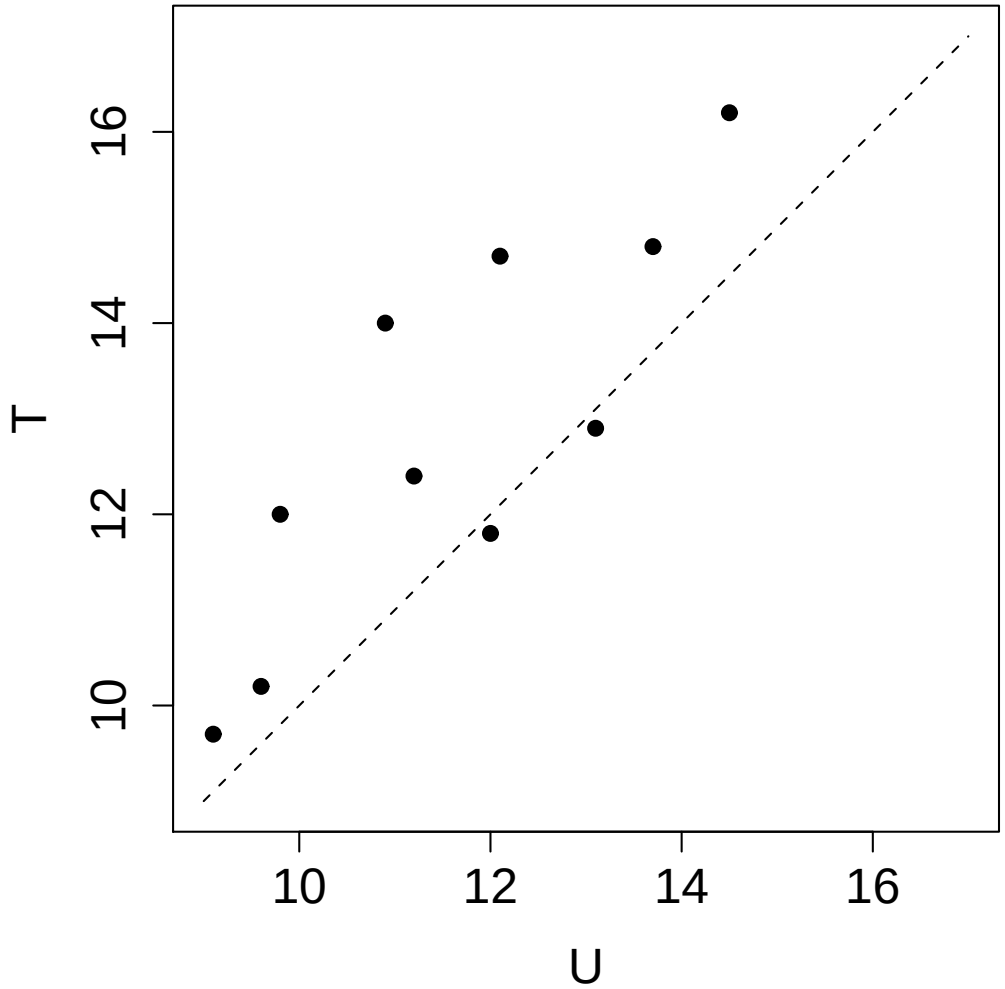
Graphical presentation of the data



Discussion

- **Why 10 test-pieces?**
- **Why cut them in half?**
- **Why randomise choice of which half to treat?**
- **What conclusions can we draw?**
- **What conclusions might we have drawn if we had chosen 10 out of 20 specimens at random to receive the chemical treatment?**

How useful was the pairing?



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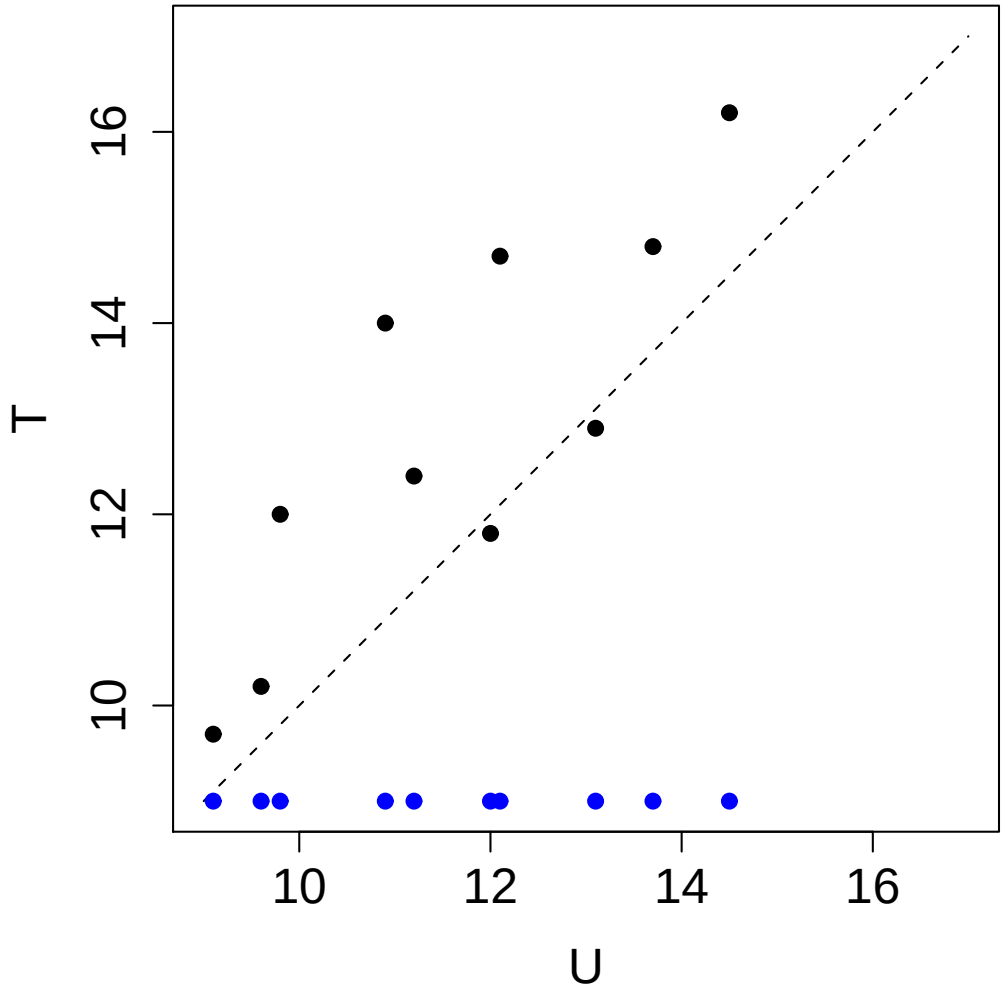

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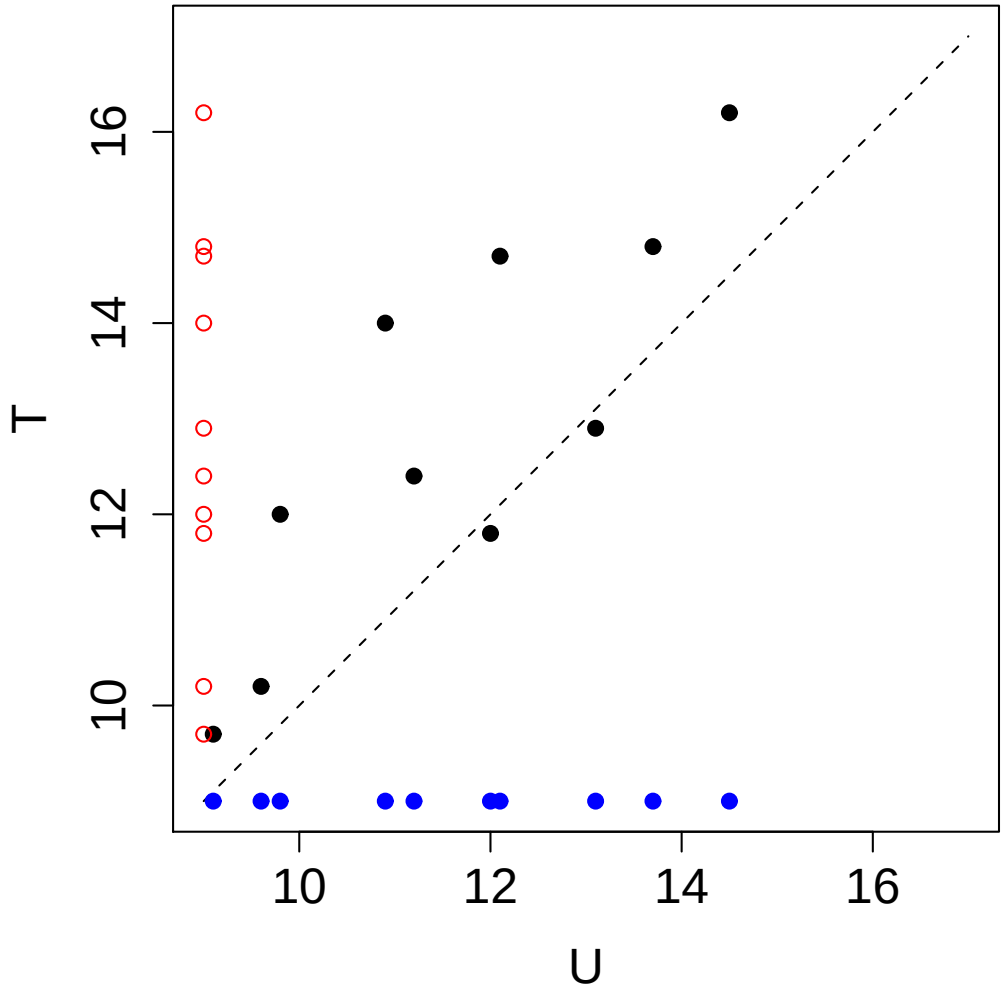

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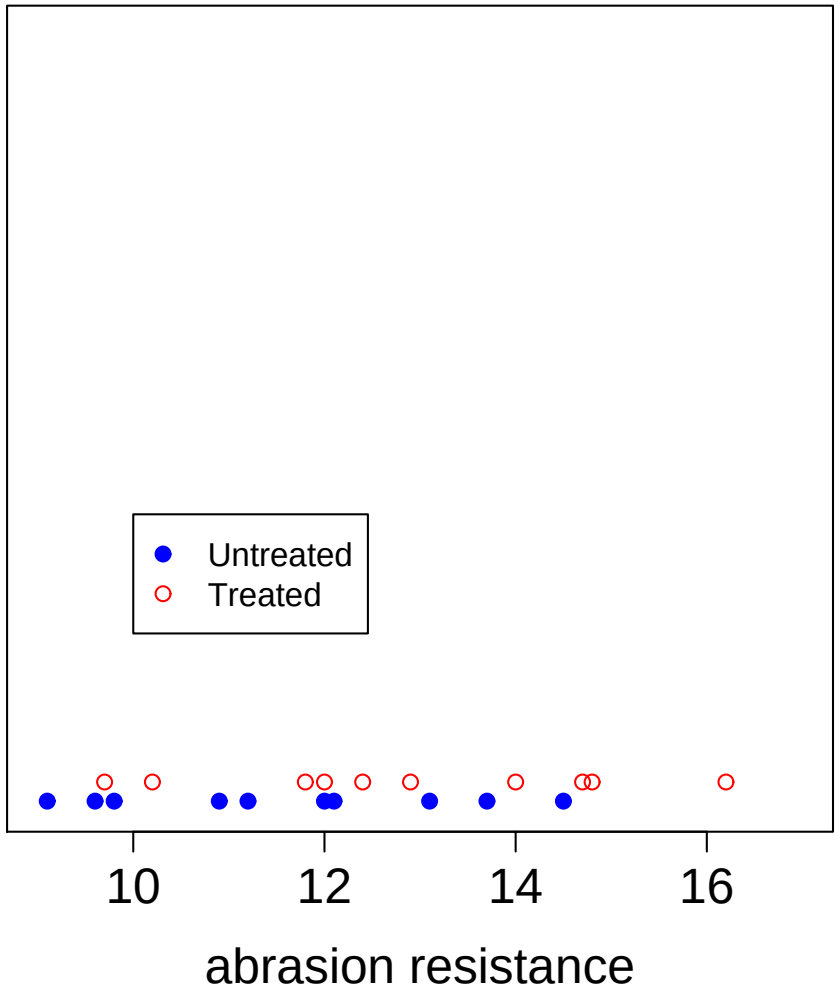

Analysing the pairwise differences

- **Observed pairwise differences**

2.6	3.1	-0.2	1.7	0.6
1.2	2.2	1.1	-0.2	0.6

- **Summary statistics**

$$n = 10 \quad \bar{d} = 1.27 \quad SD = 1.1265 \quad SE = SD/\sqrt{n} = 0.3562$$