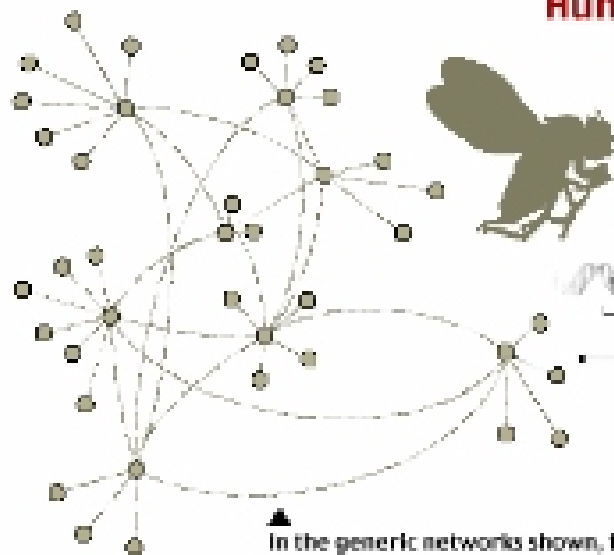


New York Times

Humans have only about three times as many genes as the fly,

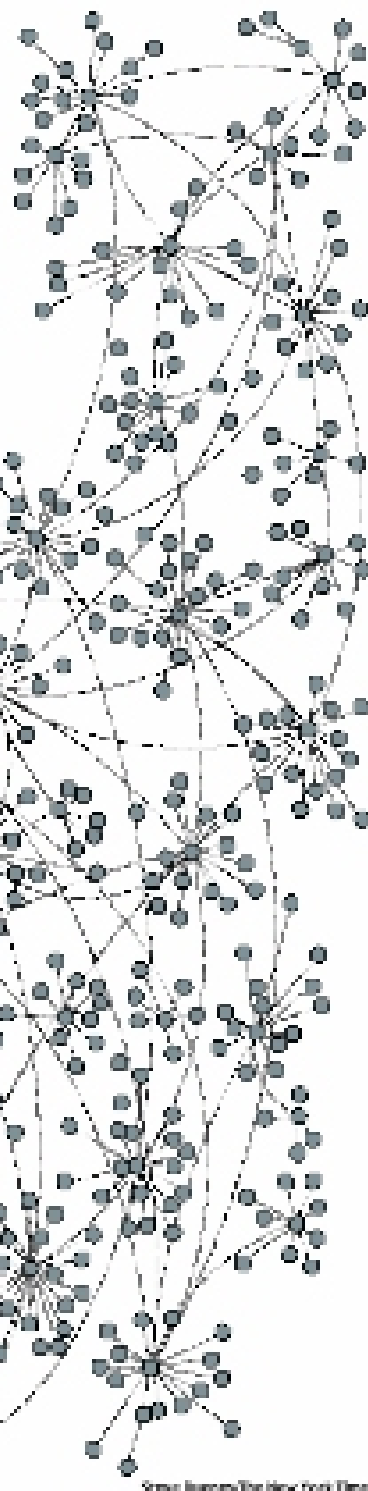
so human complexity seems unlikely to come from a sheer quantity of genes. Rather, some scientists suggest, each human has a network with different parts like genes, proteins and groups



In this example the fly has 40 genes, and the human



HOMO SAPIENS

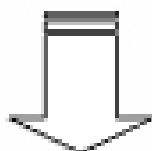


In the generic networks shown, the points represent the elements of each organism's genetic network, and the dotted lines show the interactions between them. Humans have many more ele-

Source: Dr. Albert-László Barabási, University of Notre Dame, Science & Culture Genetics

Complex systems

Made of many non-identical **elements** connected by diverse **interactions**.



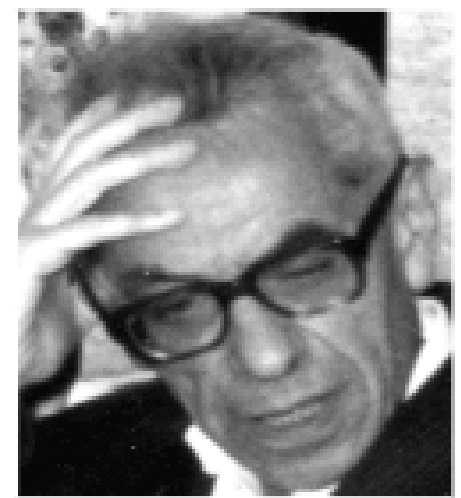
Slides: thanks to A-L Barabasi

Source: Business The New York Times

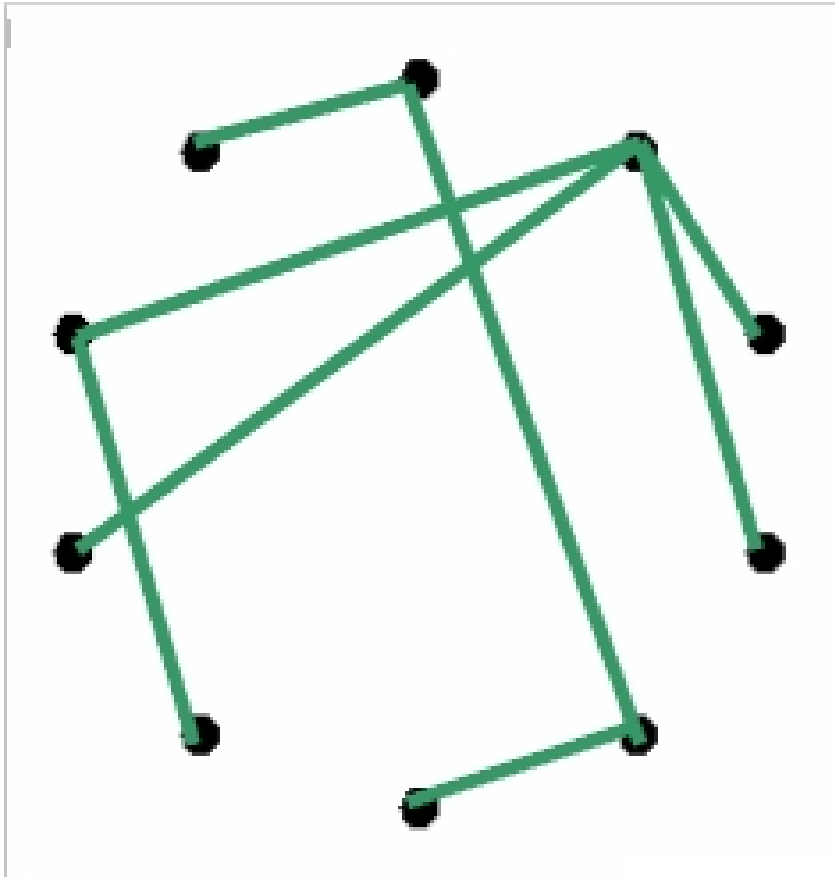
(Internet?) Big Ideas (3)

- Structure in complex networks

Erdős-Rényi model (1960)



**Pál Erdős
(1913-1996)**

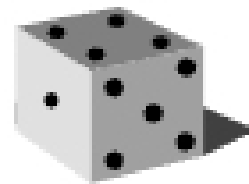


Connect with
probability p

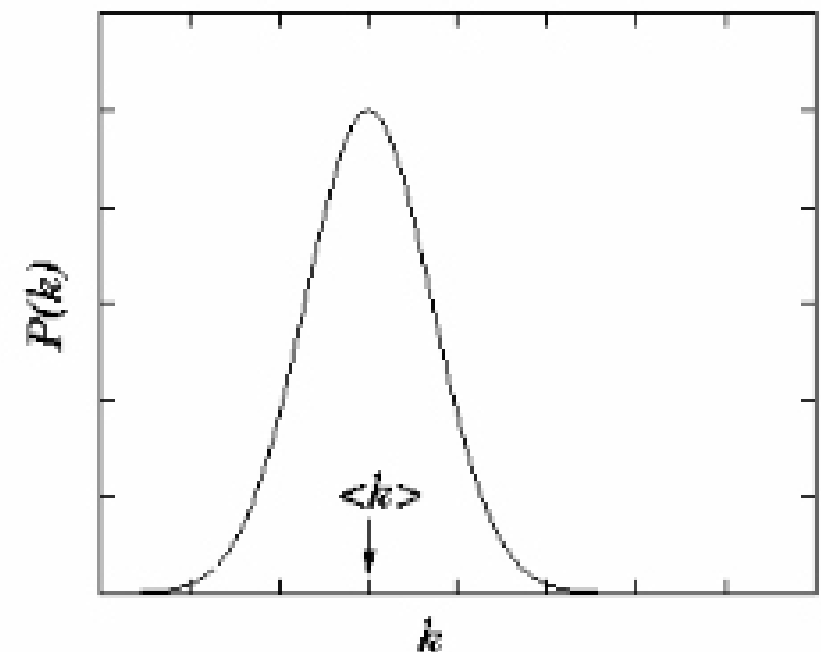
$$p=1/6$$

$$N=10$$

$$\langle k \rangle \sim 1.5$$



Poisson distribution



- **Democratic**
- **Random**