













Mode #1

Mode #2





Cande et al, eLife, 2018









Jessica Cande Gwyneth Card

David Stern



Cande et al, eLife, 2018







![](_page_15_Figure_0.jpeg)

ONTOGENY OF GROOMING

FOLLOWING

		N	E	Ea	B	S	н	Be	AG
PRECEDING	N	x	++ 25	3	0	1	0	1	ο
	E	0	x	++ 17	1	5	3	2	1
	Ea	0	0	x	++ 14	6	2	4	1
	8	0	2	1	x	3	++ 11	3	2
	s	1	0	1	4	x	++ 12	2	3
	н	1	2	2	5	7	x	6 6	0
	Be	ο	0	1	1	3	1	x	++ 9
	AG	0	0	3	0	2	0	1	x

Richmond & Sachs, Behavior, 1980

![](_page_16_Figure_0.jpeg)

![](_page_18_Figure_0.jpeg)

Final State

![](_page_19_Figure_0.jpeg)

![](_page_19_Picture_1.jpeg)

![](_page_21_Figure_0.jpeg)

## **Across Age Groups in Fruit Flies**

![](_page_22_Figure_1.jpeg)

Katherine Overman, Data from Daniel Choi & Joshua Shaevitz

![](_page_23_Picture_0.jpeg)

## Social bonding in prairie voles

![](_page_23_Picture_2.jpeg)

![](_page_23_Picture_3.jpeg)

## **Transitions in human eCoG states**

![](_page_24_Figure_1.jpeg)

![](_page_24_Figure_2.jpeg)

![](_page_24_Figure_3.jpeg)

Yating Yang, Emory '18 (now Cornell NBB)

Data From: Cory Inman & Jon Willie, Emory Neurosurgery

![](_page_25_Figure_0.jpeg)

Katherine Overman

![](_page_27_Figure_0.jpeg)

![](_page_27_Picture_1.jpeg)

![](_page_28_Picture_0.jpeg)

Hierarchical organisation: a candidate principle for ethology

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RICHARD DAWKINS (1976)

THE NEED FOR GENERAL PRINCIPLES: SOFTWARE EXPLANATION

![](_page_30_Figure_0.jpeg)

![](_page_31_Figure_0.jpeg)

GJB et al, PNAS (2016)

![](_page_32_Figure_0.jpeg)

GJB et al, PNAS (2016)

$$\mathcal{T} = rac{\mathcal{H}_f - \mathcal{H}_b}{\mathcal{H}_f}$$

![](_page_33_Figure_1.jpeg)

![](_page_35_Figure_0.jpeg)

Fig. 8. The per minute rates of occurrence of seven behaviours as a function of four 'basic' slow processes,  $v_1, \ldots, v_4$ . The thickness of the line connecting behaviour *j* with the slow process  $v_{\mu}$  is proportional to the value  $c'_{j\mu}$  in Table I. c'-coefficients with absolute values smaller than 0.05, which included all negative coefficients, were discarded.

Anim. Behav., 1973, 21, 169-182

## RANDOM PROCESSES DESCRIBING THE OCCURRENCE OF BEHAVIOURAL PATTERNS IN A CICHLID FISH

BY WALTER HEILIGENBERG Max-Planck-Institut für Verhaltensphysiologie, 8131 Seewiesen West Germany

![](_page_36_Figure_0.jpeg)

![](_page_38_Figure_0.jpeg)

![](_page_38_Figure_1.jpeg)

 $\mu = 2$ 

 $\mu = 3$ 

![](_page_39_Figure_0.jpeg)

![](_page_40_Figure_0.jpeg)

![](_page_40_Figure_1.jpeg)

![](_page_42_Picture_0.jpeg)

![](_page_43_Figure_0.jpeg)

Maximum Likelihood Dimensionality Estimation (Levina & Bickel, NIPS, 2005)

![](_page_44_Figure_0.jpeg)

![](_page_45_Figure_0.jpeg)

0.5

-0.5

![](_page_45_Figure_1.jpeg)

![](_page_45_Picture_2.jpeg)

![](_page_47_Figure_0.jpeg)

![](_page_47_Figure_1.jpeg)

![](_page_47_Figure_2.jpeg)