

## README

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Current paper title: Fitness benefits from co-display favour subdominant male-male partnerships between phenotypes

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This code was written in MatLab R2017a, © 1994-2021 The MathWorks, Inc and R package “digitize” (3.5.2 (2018-12-20) -- "Eggshell Igloo"). All the code was written for the extraction of data from published sources or for calculating predictions based on the model of resident/satellite co-display dynamics.

The code is in two parts: `main_text` and `supplementary_code`.

`main_text/functions` contains the major model functions, while `main_text/figure_2` contains the scripts for reproducing fig. 2 of the main text. Functions of these scripts can be used to find the resident and satellite reward values for any lek size or resident rank, but are written to in a single script fully reproduce the figures in the research article.

`appendix_code` holds all the scripts for reproducing the analyses and figures within the appendices 1 – 4 (figs. A1 – A14) as well as the rcode used to extract data from literature data.

To have a logical organization of the code, plot functions and model functions are in different folders. *However, all scripts act as an entire package for the paper and should be placed in the same folder location before running the scripts in MatLab.* Each function and script has its own documentation and description. Table 1Code summarizes the essential elements within the model and the code. Note that most functions call for `L`, `r`, `h`, `sat_strength`, and `comp_level` in that order this order does not change.

Table 1 Code. Model elements from *Fitness benefits from co-display favor subdominant male-male partnerships between phenotypes*. Elements (Elements) and their associated notation in the code (Element in code), how they appear in the code (Type), and their associated function name with in the code (Function).

Element	Element in code	Type	Function
$r$	r	Input variable	--
$L$	L	Input variable	--
$T$	444	Constant within a function	--
$F^{Lek}$	F_Lek	Function	Total_cops_on_lek
$B$	B	Function	Skew_of_lek
$\hat{B}$	B_Hat	Function	Norm_skew_of_lek
$K_r$	K_r	Parameter estimated within a function	--
$h$	h	Input variable	--
$H_r^h$	H_h_r	Parameter estimated within a function	--
$F_r^{Res}$	F_Res_r	Function	Single_res_cops
$F^{Sat}$	F_s	Constant within a function	--
$F^{Res\ total}$	F_Res_total	Function	Total_res_cops
$F^{Sat+Res}$	F_SatandRes	Function	Co_dis_benefit
$F_r^{Display}$	F_Dis_r	Parameter estimated within a function	Total_cops_co_dis
$D_r$	D_r	Function	Dis_risk
$M^{Sat}$	M_Sat	Input variable	--
$M_r^{Res}$	M_Res_r	Function	Mono_coeff
$C_r^{Res}$	C_Res_r	Function	Res_payoffs
$C_r^{Sat}$	C_Sat_r	Function	Sat_payoffs
$G_r^{Res}$	G_Res_r	Function	Res_reward
$G_r^{Sat}$	G_Sat_r	Function	Sat_reward
$C_r^{Res+Res\ choice}$	C_Res_r_ch	Function	Res_payoffs_res_choice
$C_r^{Sat++Res\ choice}$	C_Sat_r_ch	Function	Sat_payoffs_res_choice