

Supporting Information

Literature review methods

To get an overview of the use of OU models in ecology, evolution and palaeontology, we used Google Scholar (accessed 13th March 2015) to locate papers published
5 between 2005 (when the R package *ouch* was released; Butler and King 2004) and
2014 that contained the terms “Ornstein Uhlenbeck” and either “ecology”, or
“evolution” and “biology” (the “biology” term was added to omit physics papers
which also use the term “evolution”), or “paleo/palaeo”. We also recorded the total
number of papers containing the terms “ecology”, or “evolution” and “biology”, or
10 “paleo/palaeo”, published between 2005 and 2014 and plotted the number of OU
papers published each year as a proportion of the total number of papers published
(Fig. 1 in the main text).

Next we filtered our Google Scholar search results to focus on empirical papers
using OU models (rather than pure methods papers) published in the following
15 journals: *The American Naturalist*, *Ecology Letters*, *Evolution*, *Journal of*
Evolutionary Biology, *Nature*, *Proceedings of the National Academy of Sciences*,
USA, *Proceedings of the Royal Society B: Biological Sciences*, and *Science*. We only
include papers up to the end of 2013 to ensure completeness.

For each of these papers we recorded the number of species in the analysis, the
20 study group (amphibians, birds, fish, mammals, reptiles, invertebrates or plants), the
statistical package or specific R package used to fit the models, and the reason the
authors state for using an OU model (ancestral state reconstructions, detecting
convergent evolution, controlling for phylogeny, selecting a model of trait evolution,
or other). Where papers included multiple analyses using different numbers of
25 species we used the median number of taxa. Where papers had multiple study

groups, statistics/R packages or reasons for fitting OU models we counted them in each relevant category. We summarise these results in Figures 1 and 2 and Table 1 in the main text, and the full dataset is available in Table S1 along with the full list of references.

³⁰ **Literature review results**

In total, our literature search found 3720 papers published between 2005 and 2014, and the number has increased substantially since 2005 (Fig. 1 in main text). Most papers fit OU models to phylogenies with fewer than 100 taxa (mean = 166.97 ± 43.86 , median = 58, Figure 2 in main text and Table S1). The majority of papers fit
³⁵ OU models using R packages, particularly GEIGER and, although other uses are becoming more common, most papers use OU models in an effort to discern the “best” model of trait evolution or to control for phylogenetic non-independence (Table S1).

Table S1: Details of the papers used in our literature review. For each paper we recorded the study taxon, the number of tips in the phylogeny used to fit the Ornstein Uhlenbeck (OU) model, how the authors used the OU model in the paper, and the statistical package (usually R) used to carry out the analyses. For a full reference list see below. Journal abbreviations: Am Nat = The American Naturalist, ELE = Ecology Letters, JEB = Journal of Evolutionary Biology, PRSB = Proceedings of the Royal Society B: Biological Sciences, PNAS = Proceedings of the National Academy of the USA. Number of tips in the phylogeny the OU model was fitted to. Where there were multiple analyses in a paper we use the median number of tips. All packages mentioned are R packages apart from BayesTraits, COMPARE, MATLAB, Mesquite, PAM, PDAP and PDTREE.

	Paper	Year	Journal	Taxon	Ntips	Use in paper	Stats/R package
ω	Hansen and Orzack 2005	2005	Evolution	insects	15	other	OUCH precursor?
	Edwards and Donoghue 2006	2006	Am Nat	plants	12	ancestral state reconstruction	COMPARE
	Gvoždík and Damme 2006	2006	Evolution	amphibians	10	phylogenetic correction	COMPARE
	Halsey et al. 2006	2006	Am Nat	birds/mammals	90	phylogenetic correction	Custom code
	Ives and Godfray 2006	2006	Am Nat	insects	8	phylogenetic signal	MATLAB
	Valiente-Banuet et al. 2006	2006	PNAS	plants	47	model of evolution	? OUCH
	Clabaut et al. 2007	2007	Evolution	fish	45	phylogenetic correction	APE
	Gomez and Théry 2007	2007	Am Nat	birds	40	model of evolution	OUCH
	Hipp 2007	2007	Evolution	plants	53	model of evolution	BayesTraits
	Rezende et al. 2007	2007	Nature	plants/insects	?	phylogenetic signal	? OUCH

	Spoor et al. 2007	2007	PNAS	mammals	210	phylogenetic correction	PDAP
	StuartFox et al. 2007	2007	Am Nat	reptiles	21	phylogenetic correction	COMPARE
	Buchwalter et al. 2008	2008	PNAS	insects	21	phylogenetic correction	MATLAB
	Dumont and Payseur 2008	2008	Evolution	mammals	13	model of evolution	OUCH
	Hansen et al. 2008	2008	Evolution	mammals	105	other	SLOUCH
	Smith et al. 2008	2008	Evolution	plants	15	phylogenetic correction	APE
	Warne and Charnov 2008	2008	Am Nat	reptiles	71	phylogenetic correction	MATLAB
	Adams et al. 2009	2009	PRSB	amphibians	10	model of evolution	OUCH
	Addison et al. 2009	2009	PRSB	birds	23	phylogenetic correction	MATLAB
↳	Agrawal et al. 2009	2009	PNAS	plants	53	model of evolution	GEIGER
	Bergmann et al. 2009	2009	Evolution	reptiles	38	model of evolution	OUCH
	Collar et al. 2009	2009	Evolution	fish	29	model of evolution	OUCH
	Gonzalez-Voyer et al. 2009	2009	PRSB	fish	39	phylogenetic correction	APE/COMPARE
	Goodman et al. 2009	2009	Evolution	reptiles	20	phylogenetic correction	COMPARE
	Huey et al. 2009	2009	PRSB	reptiles	70	phylogenetic correction	MATLAB
	Kozak et al. 2009	2009	Evolution	amphibians	184	model of evolution	GEIGER
	Labra et al. 2009	2009	Am Nat	reptiles	83	other	SLOUCH
	Rezende et al. 2009	2009	ELE	fish	116	model of evolution	PDTREE
	Swanson and Garland 2009	2009	Evolution	birds	44	phylogenetic correction	MATLAB

	Van Buskirk 2009	2009	JEB	amphibians	82	other	SLOUCH
	Burbrink and Pyron 2010	2010	Evolution	reptiles	29	model of evolution	GEIGER
	Cooper and Purvis 2010	2010	Am Nat	mammals	45	model of evolution	GEIGER
	Edwards and Smith 2010	2010	PNAS	plants	300	model of evolution	OUCH
	Harmon et al. 2010	2010	Evolution	multiple	17	model of evolution	GEIGER
	Helmus et al. 2010	2010	ELE	zooplankton	15	phylogenetic correction	?
	Kalinka et al. 2010	2010	Nature	insects	6	model of evolution	OUCH
	Kozak and Wiens 2010b	2010	Am Nat	amphibians	84	model of evolution/ ancestral state reconstruction	GEIGER/ OUCH
5	Kozak and Wiens 2010a	2010	ELE	amphibians	11	model of evolution	OUCH
	Ord et al. 2010	2010	Evolution	reptiles	16	other	SLOUCH
	Price et al. 2010	2010	Evolution	fish	122	model of evolution	GEIGER
	Slater et al. 2010	2010	PRSB	mammals	84	model of evolution	OUCH
	Angielczyk et al. 2011	2011	Evolution	reptiles	8	model of evolution	OUCH
	Benesh et al. 2011	2011	Evolution	helminths	310	model of evolution	OUCH
	Collar et al. 2011	2011	Evolution	reptiles	37	model of evolution	Brownie
	Derryberry et al. 2011	2011	Evolution	birds	285	model of evolution	GEIGER
	Galvan and Moller 2011	2011	JEB	birds	323	phylogenetic correction	COMPARE
	Gonzalez-Voyer and Kolm 2011	2011	JEB	fish	49	model of evolution	GEIGER

Ord et al. 2011	2011	Evolution	multiple	23	phylogenetic signal	SLOUCH
Oufiero et al. 2011	2011	Evolution	reptiles	106	phylogenetic correction	SLOUCH
Perez et al. 2011	2011	JEB	mammals	29	phylogenetic correction	APE
Raia and Meiri 2011	2011	Evolution	mammals	842	model of evolution	MOTMOT
Rosas-Guerrero et al. 2011	2011	Evolution	plants	20	phylogenetic correction	APE
Setiadi et al. 2011	2011	Am Nat	amphibians	22	model of evolution	OUCH
Smith et al. 2011	2011	Evolution	reptiles	15	model of evolution	GEIGER
Tulli et al. 2011	2011	JEB	reptiles	29	phylogenetic correction	?
Turbill et al. 2011	2011	PRSB	mammals	19	phylogenetic correction	GEIGER
Valido et al. 2011	2011	JEB	plants	111	phylogenetic correction	APE
Wiens et al. 2011	2011	ELE	amphibians	337	model of evolution/ phylogenetic correction	GEIGER/ COMPARE
Weir and Wheatcroft 2011	2011	PRSB	birds	232	model of evolution	GEIGER
Beaulieu et al. 2012	2012	Evolution	plants	590	model of evolution	OUwie
Betancur-R et al. 2012	2012	ELE	fish	123	model of evolution	GEIGER
Blankers et al. 2012	2012	JEB	amphibians	189	phylogenetic correction	GEIGER
Boettiger et al. 2012	2012	Evolution	reptiles	23	ancestral state reconstruction	OUCH
Burbrink et al. 2012	2012	PRSB	multiple	41	model of evolution	Custom code
Calosi et al. 2012	2012	JEB	insects	25	phylogenetic correction	MATLAB

	Claramunt et al. 2012a	2012	Am Nat	birds	290	model of evolution	GEIGER
	Claramunt et al. 2012b	2012	PRSB	birds	282	model of evolution	GEIGER
	Davis et al. 2012	2012	JEB	insects	53	phylogenetic correction	SLOUCH
	Diniz-Filho et al. 2012	2012	Evolution	mammals	209	other	PAM
	Fusco et al. 2012	2012	Evolution	trilobites	60	model of evolution	?
	Gomez-Mestre et al. 2012	2012	Evolution	amphibians	720	phylogenetic correction	APE
	Ingram et al. 2012	2012	JEB	food webs	20	model of evolution	GEIGER
	Kellermann et al. 2012a	2012	Evolution	insects	94	phylogenetic correction	SLOUCH
	Kellermann et al. 2012b	2012	PNAS	insects	94	phylogenetic correction	SLOUCH
↙	Nogueira et al. 2012	2012	JEB	plants	105	phylogenetic signal	GEIGER
	Ord 2012	2012	JEB	reptiles	32	ancestral state reconstruction	SLOUCH
	Pearse and Hipp 2012	2012	Evolution	plants	56	phylogenetic correction	SLOUCH
	Pellissier et al. 2012	2012	JEB	insects	83	model of evolution	? APE
	Price et al. 2012	2012	Evolution	fish	50	model of evolution	GEIGER
	Sallan and Friedman 2012	2012	PRSB	fish	100	model of evolution	GEIGER
	Santana et al. 2012	2012	Evolution	mammals	85	model of evolution	OUCH
	Schmerler et al. 2012	2012	PRSB	plants	88	phylogenetic correction	nlme
	Smith 2012	2012	Evolution	birds	42	phylogenetic correction	APE/nlme
	Sookias et al. 2012	2012	PRSB	multiple	43	model of evolution	GEIGER

	Stireman et al. 2012	2012	JEB	insects	24	model of evolution	GEIGER
	Voje and Hansen 2012	2012	Evolution	insects	30	phylogenetic correction	SLOUCH
	Weir et al. 2012	2012	Evolution	birds	232	model of evolution	GEIGER
	Arbour and López-Fernández 2013	2013	PRSB	fish	27	model of evolution	OUCH
	Benesh et al. 2013	2013	Am Nat	helminths	143	phylogenetic correction	APE
	Blackburn et al. 2013	2013	Evolution	amphibians	18	model of evolution	GEIGER
	Christin et al. 2013	2013	PNAS	plants	545	model of evolution	GEIGER/OUCH
	Frédérich et al. 2013	2013	Am Nat	fish	208	model of evolution	OUwie
∞	Friedman et al. 2013	2013	Evolution	birds	15	model of evolution	OUCH
	Guerrero et al. 2013	2013	PNAS	plants/reptiles	49	ancestral state reconstruction	GEIGER/ COMPARE
	Hertz et al. 2013	2013	Evolution	reptiles	100	model of evolution	GEIGER
	Hossie et al. 2013	2013	JEB	amphibians/ reptiles	104	phylogenetic correction	GEIGER
	Knope and Scales 2013	2013	JEB	fish	26	model of evolution	OUCH
	Kostikova et al. 2013	2013	Am Nat	plants	68	model of evolution	OUwie
	Lambert and Wiens 2013	2013	Evolution	reptiles	117	ancestral state reconstruction	GEIGER
	Lapiedra et al. 2013	2013	PRSB	birds	154	model of evolution	OUwie

Litsios et al. 2013	2013	Evolution	plants	382	model of evolution	OUwie
López-Fernández et al. 2013	2013	Evolution	fish	135	model of evolution	GEIGER
Machac et al. 2013	2013	Evolution	mammals	231	model of evolution	GEIGER
Mahler et al. 2013	2013	Science	reptiles	100	convergent evolution	SURFACE
Maia et al. 2013	2013	PNAS	birds	47	model of evolution	OUwie
Mirceta et al. 2013	2013	Science	mammals	130	phylogenetic correction/ ancestral state reconstruction	Mesquite/ MATLAB
Moen et al. 2013	2013	PRSB	amphibians	44	convergent evolution	GEIGER
Pérez i de Lanuza et al. 2013	2013	JEB	reptiles	42	ancestral state reconstruction	GEIGER
Pienaar et al. 2013	2013	ELE	birds	382	model of evolution	SLOUCH
Quintero and Wiens 2013	2013	ELE	multiple	500	ancestral state reconstruction	GEIGER/COMPARE
Ryan and Shaw 2013	2013	PRSB	mammals	34	phylogenetic correction	MATLAB
Seddon et al. 2013	2013	PRSB	birds	153	model of evolution	? GEIGER
Tanabe and Sota 2013	2013	Evolution	millipedes	84	phylogenetic correction	APE
Voje et al. 2013	2013	JEB	fish	87	other	SLOUCH
Wiens et al. 2013	2013	Evolution	reptiles	117	ancestral state reconstruction	GEIGER

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