#### Extensions of simple biset functors

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Extensions of simple biset functors

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Let R be a commutative ring

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Let *R* be a commutative ring, and *RC* be the following category: The objects of *RC* are the finite groups.

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- So For finite groups G and H, the hom set  $Hom_{RC}(G, H)$

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A biset functor over R is an R-linear functor from RC to R-Mod. Biset functors over R form an abelian category  $\mathcal{F}_R$ .

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• The representation functor  $G \mapsto R_{\mathbb{K}}(G)$ 

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- Let (H, W) as above, and G be a finite group. Then  $S_{H,W}(G) \neq 0 \implies H \sqsubseteq G$  (H is a subquotient of G).

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- **Example:** Let  $\mathbb{F}$  be a field of characteristic 0.

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 $\operatorname{Hom}_{\mathcal{F}_R}(Y_G,F)\cong F(G) \text{ for any } F\in \mathcal{F}_R.$ Hence  $Y_G$  is projective in  $\mathcal{F}_R$ , and  $\operatorname{End}_{\mathcal{F}_R}(Y_G)\cong RB(G,G)$ 

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Hence  $Y_G$  is projective in  $\mathcal{F}_{R_i}$  and  $\operatorname{End}_{\mathcal{F}_R}(Y_G) \cong RB(G, G)$  is the double Burnside algebra of G over R.

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### Assume $R \supseteq \mathbb{Q}$ .

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Assume  $R \supseteq \mathbb{Q}$ . Let  $R\mathcal{D}$  be the following category:

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For finite groups G and H

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Extensions of simple biset functors

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Image: A matrix

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## Simple functors and *B*-groups

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## Groups of odd order

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Extensions of simple biset functors

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- $\beta_2(G)$  is a  $B_2$ -group, and  $G \longrightarrow \beta_2(G)$ .
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### Proposition

- **3**  $0 \leq F_2 < F_1 \leq \mathbb{F}_2 B_{|odd}$  with  $F_1/F_2 \cong S_{H,W}^{\mathbb{F}_2} \Leftrightarrow \Phi(H) = 1$  and  $W = \mathbb{F}_2$ .

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$$\dim_{\mathbb{F}_2} S_{H,\mathbb{F}_2}(G) = \big| \{ K \leq G \mid K/\Phi(K) \cong H, K \text{ up to } G \} \big|.$$
# Extensions

Serge Bouc (CNRS-LAMFA) Extensions of simple biset functors

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# Theorem

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- I has odd prime order

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**③** *H* has odd prime order, and 
$$W = \mathbb{F}_2$$
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$$\mathrm{Ext}^{1}_{\mathcal{F}_{\mathbb{F}_{2}}}(S_{1,\mathbb{F}_{2}},S_{\mathcal{H},\mathcal{W}})\cong\mathbb{F}_{2}\cong\mathrm{Ext}^{1}_{\mathcal{F}_{\mathbb{F}_{2}}}(S_{\mathcal{H},\mathcal{W}},S_{1,\mathbb{F}_{2}}).$$

# THANK YOU!

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Extensions of simple biset functors

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