KU LEUVEN

How To Go Eff Without A Hitch

On Efficient Compilation From Eff to OCaml

Stien Vanderhallen
Georgios Karachalias
Tom Schrijvers

EFF

= programming language with algebraic effects

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Computational Effects

Exception throwing	Global state manipulation	I/O
`throw`	`get`	`read`
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EFF

= programming language with algebraic effects

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Algebraic Computational Effects

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`handle … with …`	`handle … with …`	`handle … with …`

see also: M. Pretnar, *An Introduction to Algebraic Effect Handlers,* MFPS 2015.

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HITCH : how to compile Eff?

see also: M. Pretnar, *An Introduction to Algebraic Effect Handlers,* MFPS 2015.

What the Eff?

```
effect flip_a_coin : unit -> bool;;

let coin_flipper = handler
    | #flip_a_coin () k -> k true
    | return x -> x
in

handle (if #flip_a_coin ()
            then 1
            else 2 + 3 )
with coin_flipper
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HITCH : how to compile?

HITCH : how to compile efficiently?

Naive compilation

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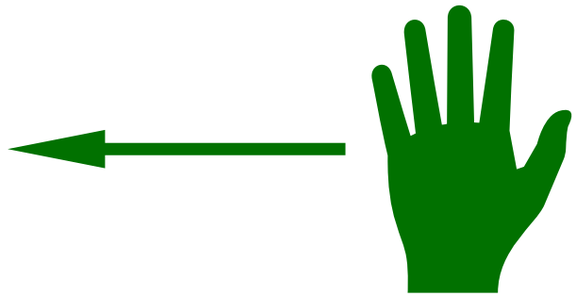

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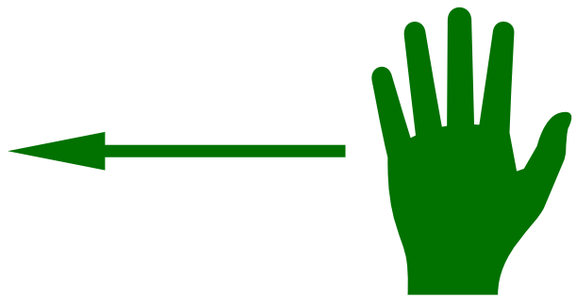

SEQUENCING

OCaml

```
flip_a_coin () >>= \x ->
if x then (return 1) else
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      p  2 >>= \r ->
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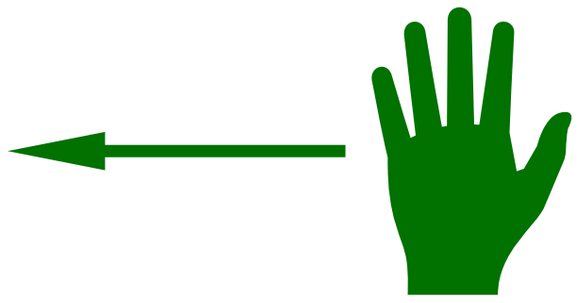

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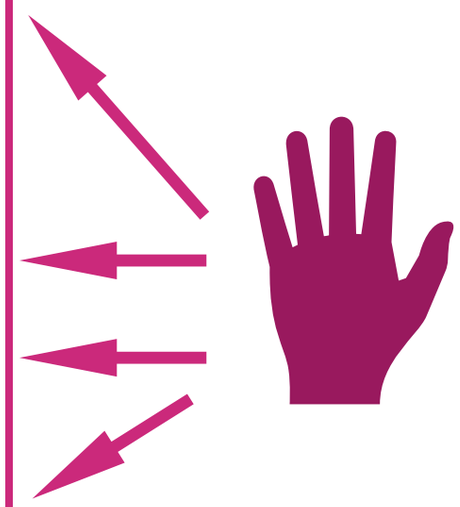

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HITCH : expensive!

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HITCH : unnecessary!

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flip_a_coin () >>= \x ->
if x then (return 1) else
    let r = 2 + 3
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Eff

SOLUTION : keep track of effect information

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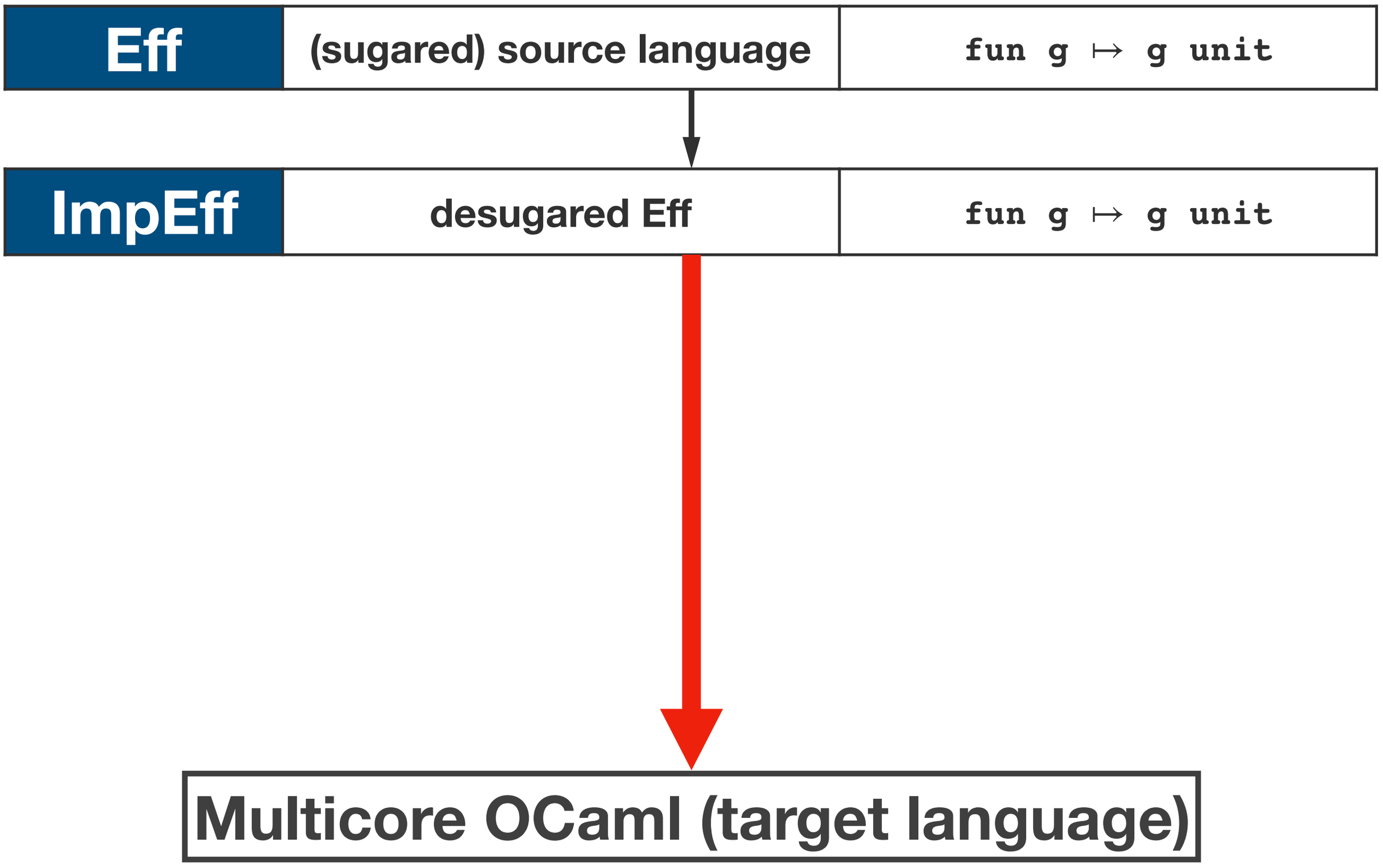
Original Approach



Current Approach

Eff	(sugared) source language	`fun g ↦ g unit`
ImpEff	desugared Eff	`fun g ↦ g unit`
ExEff	**explicit optimisable (unnecessarily) elaborate**	$\Lambda\alpha\,.\,\Lambda\alpha'\,.\,\Lambda\delta\,.\,\Lambda\delta'\,.\,\Lambda(\omega : \alpha \leqslant \alpha')\,.$ $\Lambda(\omega' : \delta \leqslant \delta')\,.$ **fun (g : Unit** $\mapsto$ $\alpha!\delta$**)** $\mapsto$ **(g unit)** $\triangleright$ $(\omega!\omega')$
SkelEff	**erased ExEff**	$\Lambda\varsigma\,.$ **fun** (g : Unit $\mapsto$ ς) $\mapsto$ **g unit**

Multicore OCaml (target language)

see also: A. H. Saleh et al., *Explicit Effect Subtyping,* ESOP 2018.

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HITCH : target language with effects

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Ongoing Work

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Pure languages (Plain OCaml)

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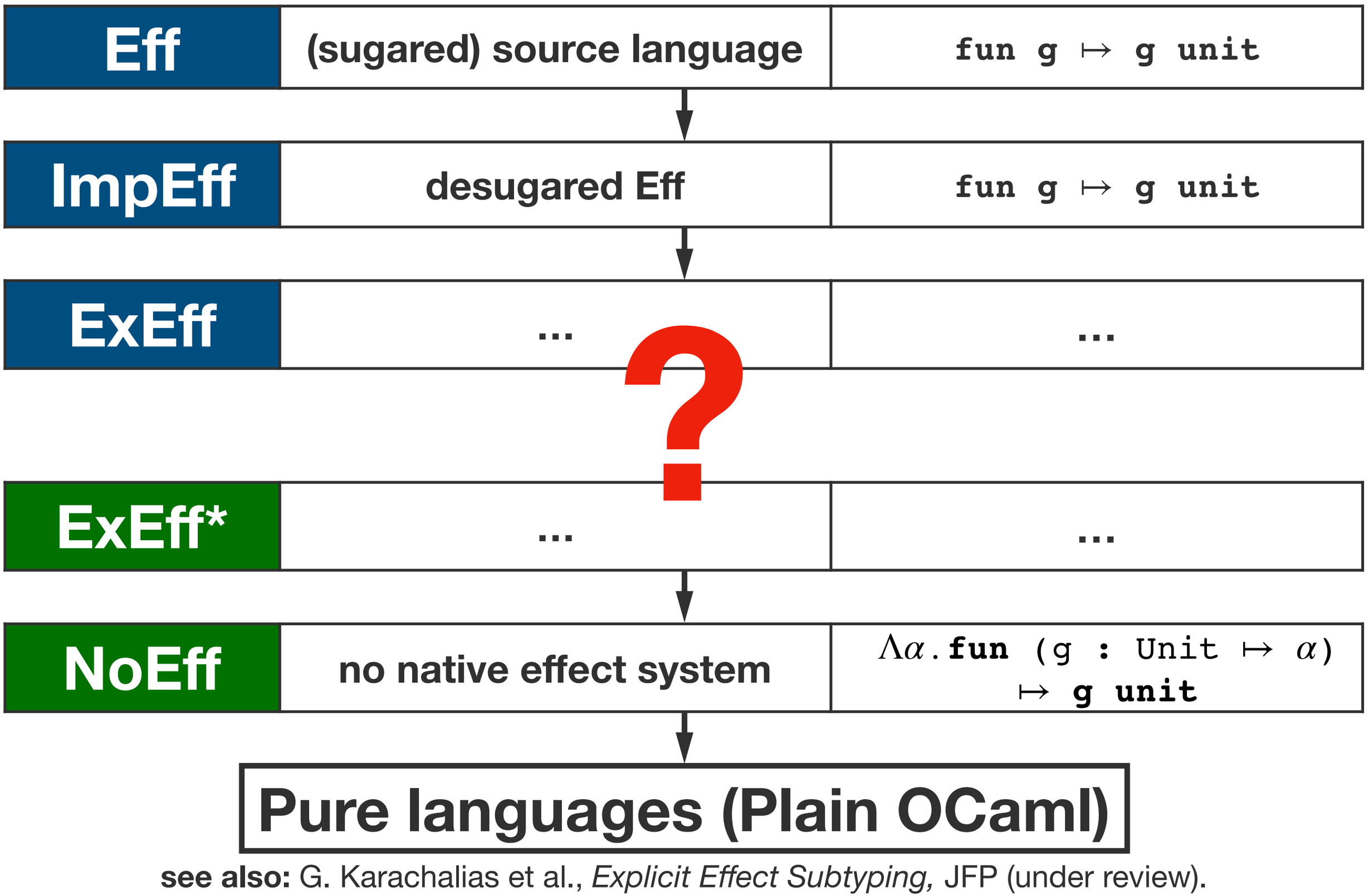

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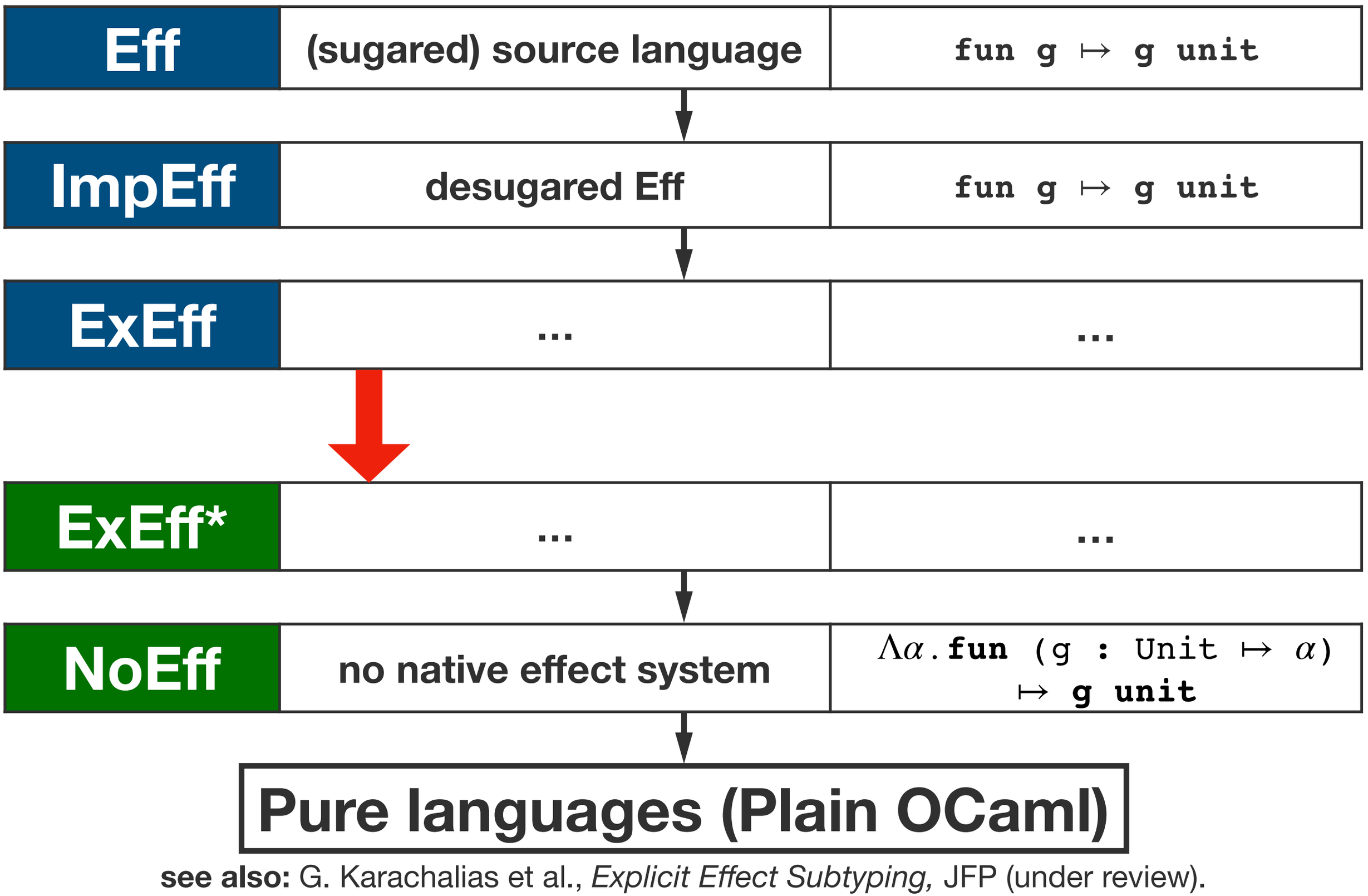

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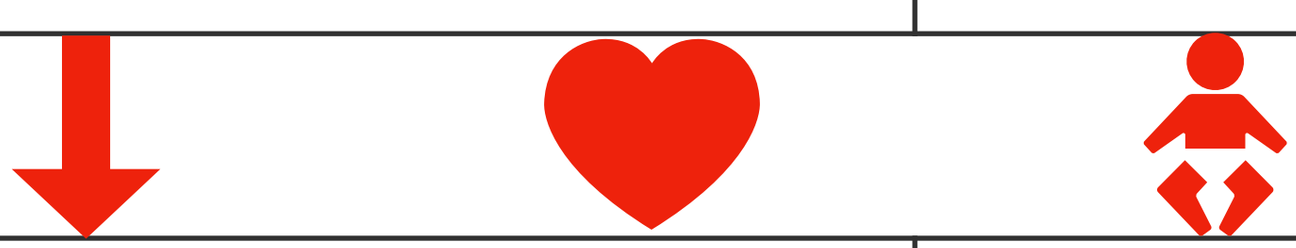

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Thank you!

Any questions?

References

(1) **Bauer, A., Pretnar, M.**: *Programming with algebraic effects and handlers*. J. Log. Algebr. Meth. Program. 84(1), 108–123 (2015)

(2) **Karachalias, G., Pretnar, M., Saleh, A.H., Schrijvers, T.**: *Explicit effect subtyping* (2019), under consideration for publication in J. Functional Programming

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(5) **Saleh, A.H., Karachalias, G., Pretnar, M., Schrijvers, T.**: *Explicit effect subtyping*. In: 27th European Symposium on Programming (ESOP) (2018)

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