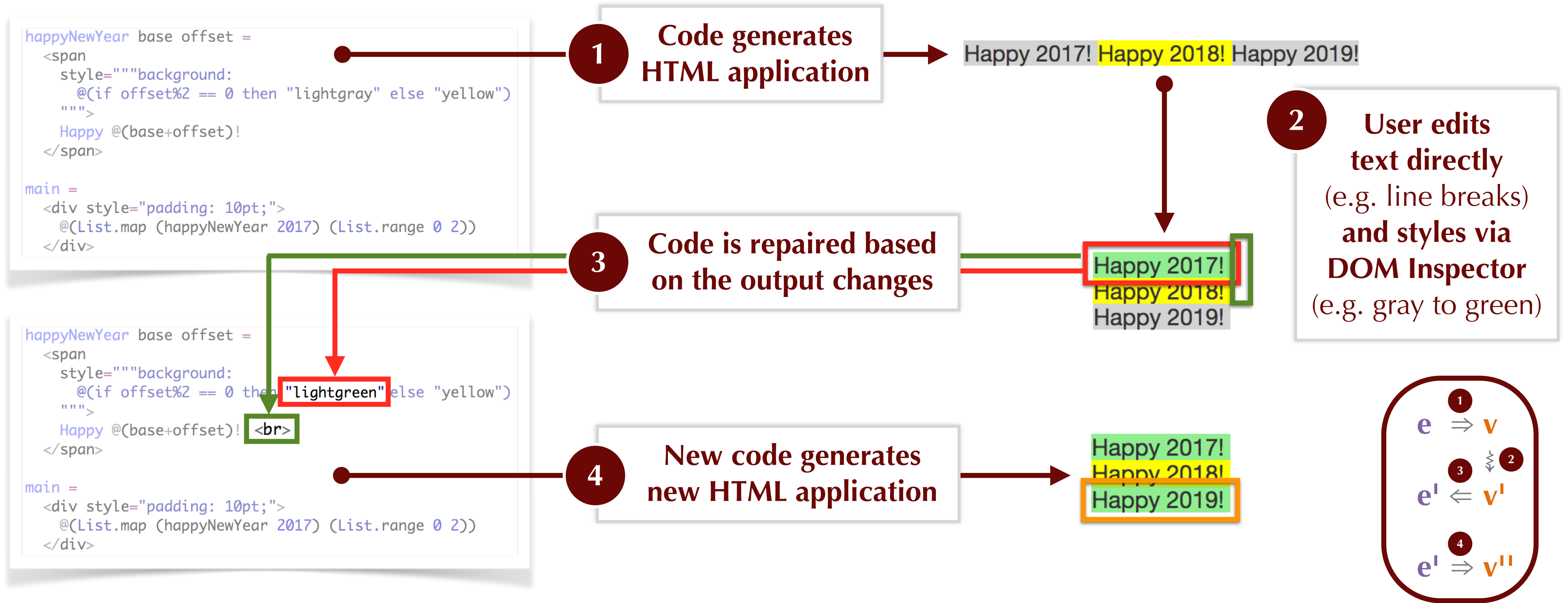


# Bidirectional Web Programming in Sketch-n-Sketch

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## Edit source code by editing the output?



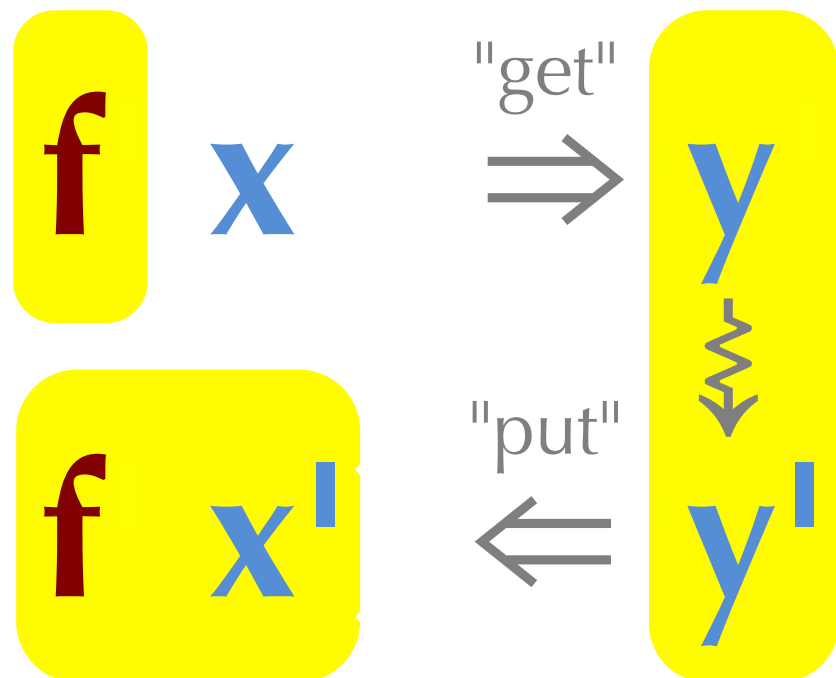
### Traditional Lens Programming

### Our Approach: Bidirectional Evaluation

$$\left\{ \begin{array}{l} \text{get} : A \rightarrow B \\ \text{put} : B \rightarrow A \rightarrow A \end{array} \right\}$$

$$\left\{ \begin{array}{l} \text{eval} : \text{Exp} \rightarrow \text{Val} \\ \text{uneval} : \text{Val} \rightarrow \text{Exp} \rightarrow \text{Exp} \end{array} \right\}$$

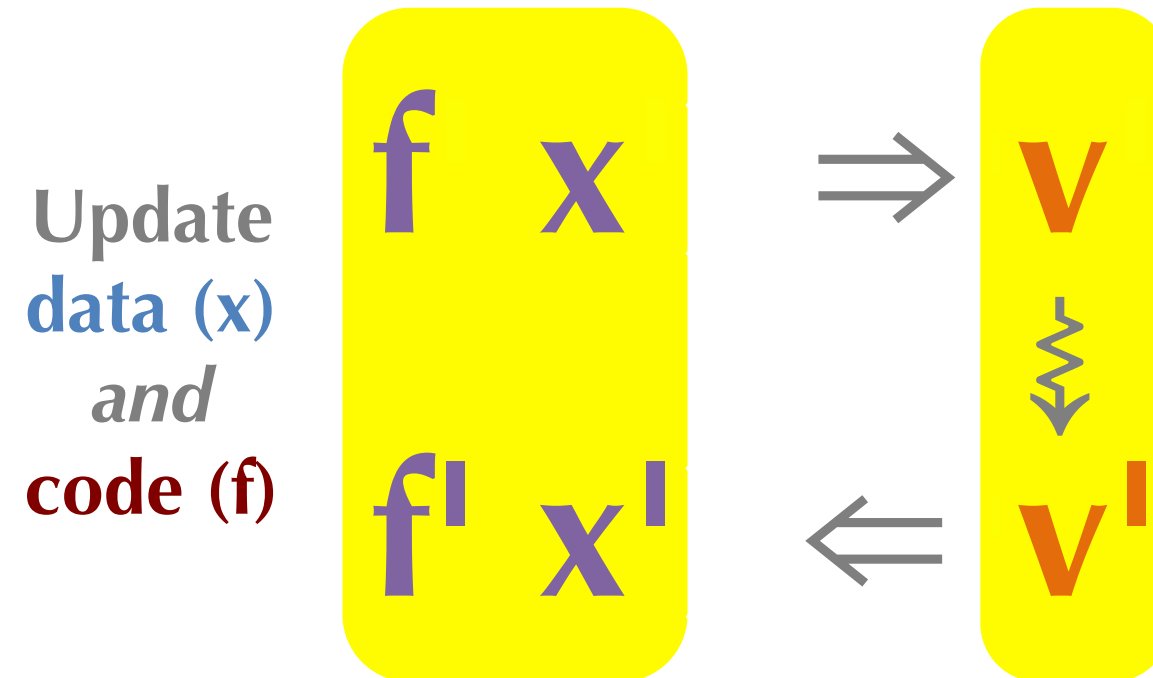
1. Function  $f$  in DSL or restricted style (i.e. point-free)



3. Update "data" ( $x$ ) but not "code" ( $f$ )

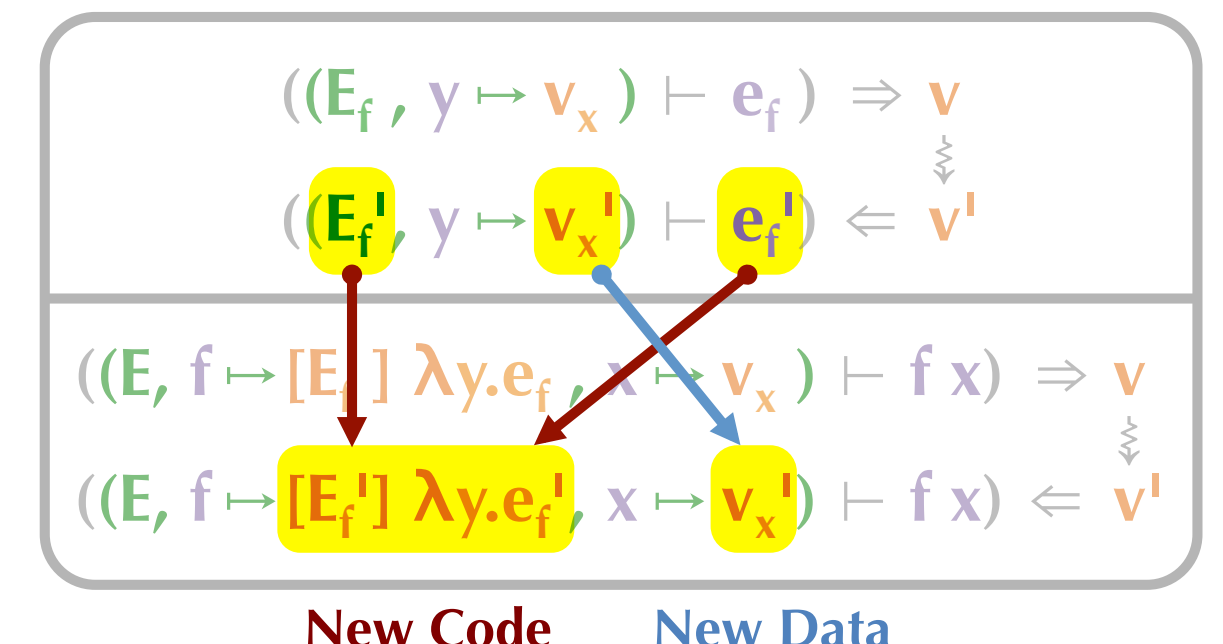
2. Restricted structural changes between  $y$  and  $y'$

All expressions can be run backwards and updated

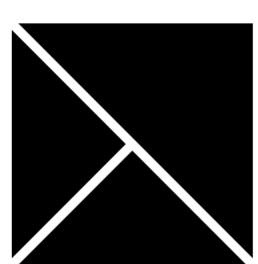


"Small" structural changes to values + user-defined lenses for customization

Key Idea



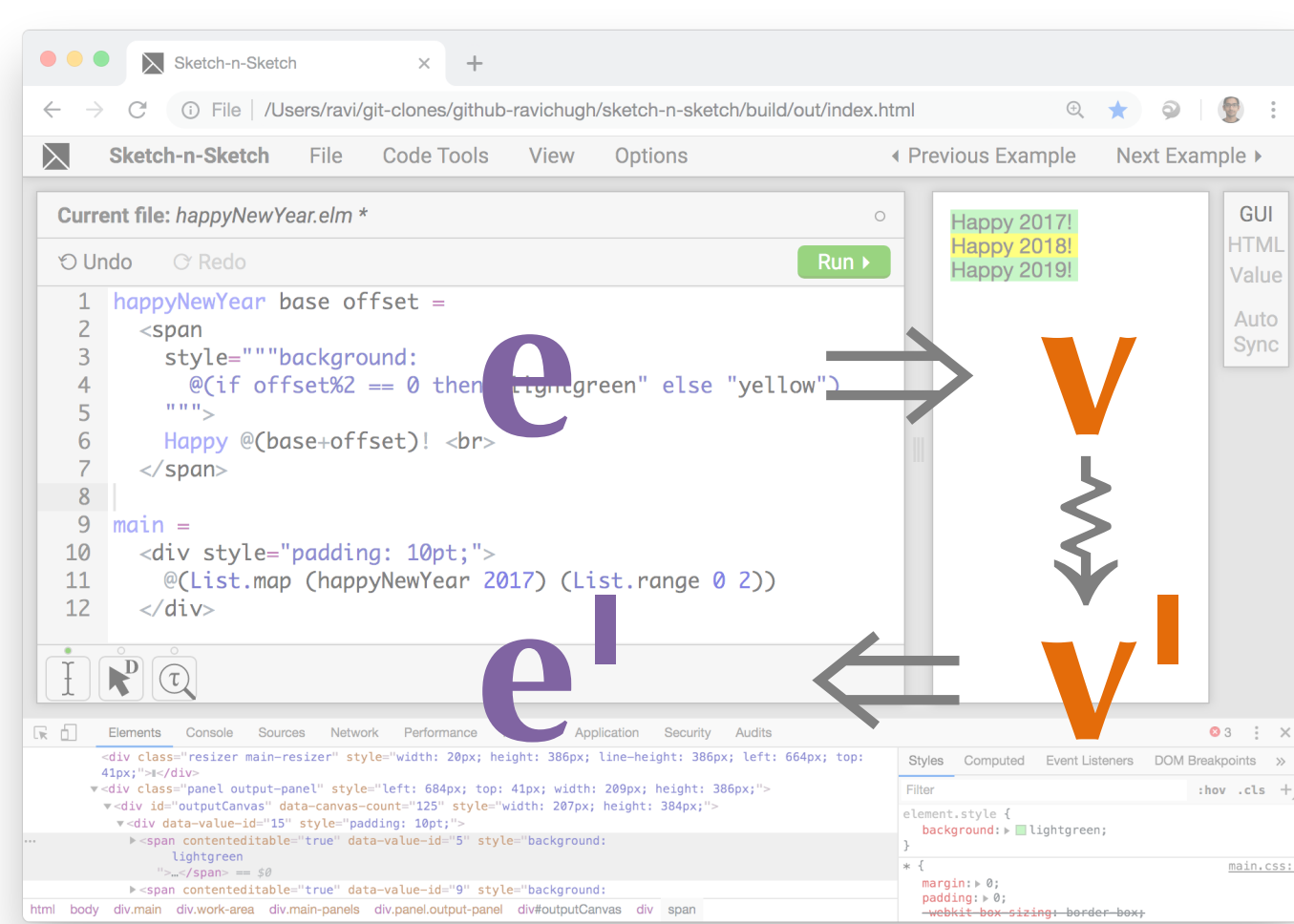
### Prototype Systems and Examples



**Sketch-n-Sketch**

[ravichugh.github.io/sketch-n-sketch](http://ravichugh.github.io/sketch-n-sketch)

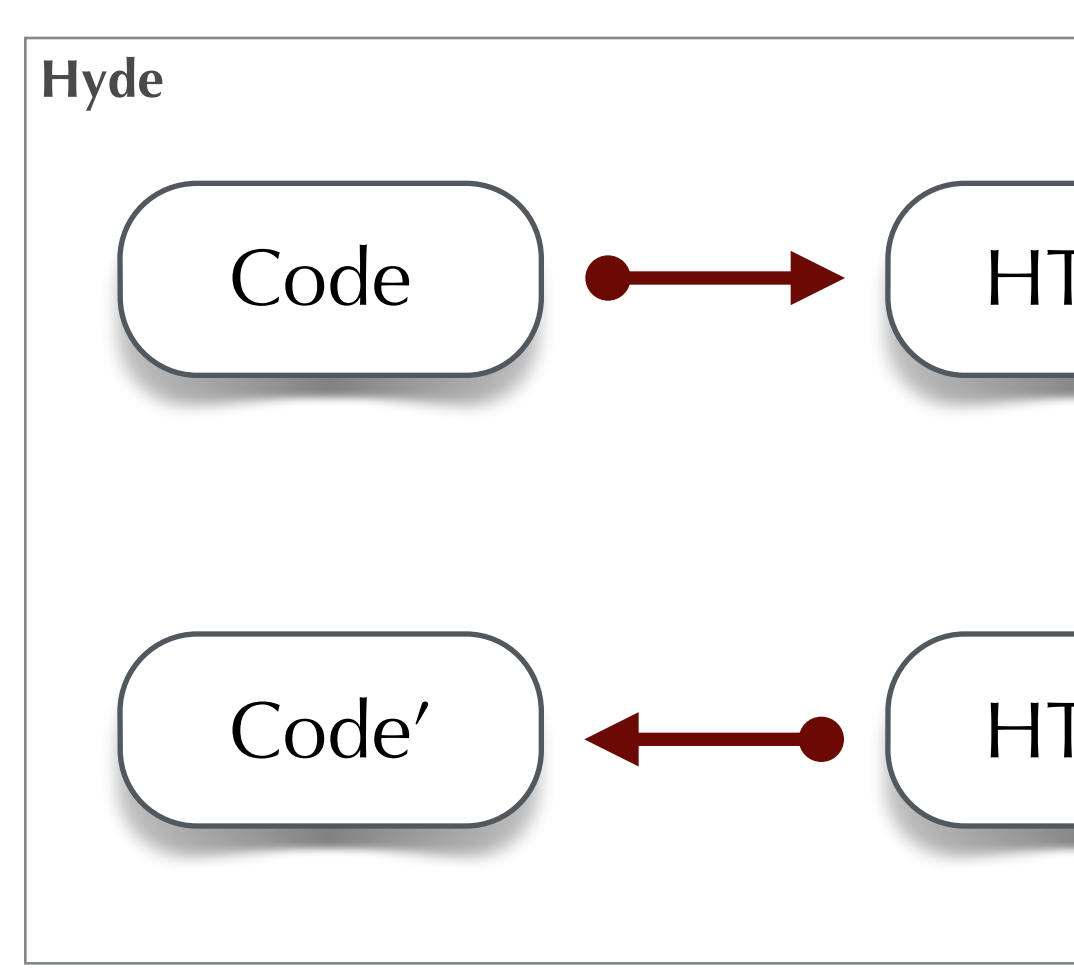
Bidirectional HTML development in a browser-based IDE



**Hyde Build Tool**

[github.com/MikaelMayer/hyde-build-tool](https://github.com/MikaelMayer/hyde-build-tool)

Bidirectional file manipulation (à la Jekyll, Hugo, Hexo)



**Tharzen**

[github.com/MikaelMayer/Editor](https://github.com/MikaelMayer/Editor)

Bidirectional web server for HTML and PHP development

