

# marky Documentation – pdf

lehmann7

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**Abstract** – marky is a preprocessor with an easy and intuitive syntax for execution of embedded [python](#) code during rendering `html` and `pdf` documents from Markdown text. This document is created using marky, version *0.9*. For more information please refer to the `marky` repository.

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## 1 marky Dynamic Markdown

`marky` is a Markdown preprocessor which transforms a Markdown document using python. `marky` implements three statements with extremely easy and intuitive syntax, which are embedded directly in the Markdown text:

1. `<?...?>`: Python code block.
2. `{{...}}`: f-string output into Markdown.
3. `___()`: Function for output into Markdown.

Using `<?...?>` and `{{...}}` python code and f-string output are embedded directly inside the Markdown text.

### Example 1: Inline Formatted Ouput

```
<?
x = 123.45
LEG = lambda v, w: "lesser" if v < w else "equal or greater"
?>
```

This is an example with a value `x={{x:.3f}}`,  
which is `{{LEG(x, 100)}}` than 100.

### Run and Output

This is an example with a value `x=123.450`,  
which is equal or greater than 100.

Using the `___()` function text is generated from python algorithms and dynamically inserted into the resulting Markdown.

### Example 2: Dynamic Text from Code

```
<?
for i in range(3):
    ___(f"{i+1}. `i = {i}`", "abcdefghij"[0:(i+1)*3])
?>
```

#### Run and Output

```
1. `i = 0` abc
2. `i = 1` abcdef
3. `i = 2` abcdefghi
```

Python code, which is embedded in the Markdown text follows the Python indentation standard. Markdown text is integrated into the program flow when being inserted in python statements accordingly.

### Example 3: Text in Condition

```
This is the first line.
<?
if False:
    ?>This Line is **not** shown.<?
else:
    ?>This Line is shown.<?
?>
This is the last line.
```

#### Run and Output

```
This is the first line.
This Line is shown.
This is the last line.
```

### Example 4: Text in Program Flow

```
<?
for i in range(3):
    ?>{{i+1}}. `i = {{i}}` in this iteration.
```

```
<?
?>
```

## Run and Output

1. ``i = 0`` in this iteration.
2. ``i = 1`` in this iteration.
3. ``i = 2`` in this iteration.

### 1.1 A First marky Example

marky combines python expressions with Markdown, for dynamic creation of text. In the following, two in-depth examples of marky are presented.

#### Example 1: marky Syntax

```
<?
x = 123
y = 45
def abc_fun(v, a, b, c):
    return a if v < 100 else b if v == 100 else c
LEG = lambda v: abc_fun(v, "lesser", "equal", "greater")
?>
```

This is an example with a value `x={{x}}`, which is `{{LEG(x)}}` than 100. There is another value `y={{y}}`, which is `{{LEG(y)}}` than 100. Both values together are `x+y={{x+y}}`.

## Run and Output

This is an example with a value `x=123`, which is greater than 100. There is another value `y=45`, which is lesser than 100. Both values together are `x+y=168`.

The following example contains meta data in the front matter and can be rendered into pdf and html by just calling `make pdf/file` or `make html/file`.

#### Example 2: md/file.md

```
---
title: An Example
```

```

---
<?
def cap_first(i):
    return " ".join([i[0].upper() + i[1:] for i in i.split()])
for i in ["very", "not so"]:
    ?>
**{{cap_first(i)}} Section**

To day is a {{i}} very nice day.
The sun is shining {{i}} bright and
the birds are singing {{i}} loud and
fly {{i}} high in the {{i}} blue sky.
<?
?>

```

#### Output build/file.md

```

---
title: An Example
---

**Very Section**

To day is a very very nice day.
The sun is shining very bright and
the birds are singing very loud and
fly very high in the very blue sky.

**Not So Section**

To day is a not so very nice day.
The sun is shining not so bright and
the birds are singing not so loud and
fly not so high in the not so blue sky.

```

## 1.2 How does marky work internally?

marky uses an extremely simple mechanism for generating a python program from the Markdown text. Using the `<?...?>` and `{{...}}` state-

ment, Python code is embedded into the Markdown text and translated into a series of calls to the `___()` function using f-strings as arguments, where python variables are referenced. This results into a python program which can generate Markdown text algorithmically.

#### Example: md/file.md

```
* This is {first}. <?
x = 1 # this is code
for i in range(3):
    if x:
        ?>
{{i+1}}. The value is {{x}}.
<?
    else:
        ?>{{i+1}}. The value is zero.
<?
    x = 0
?>* This is last.
```

The file produces the following Markdown output.

#### Output: Markdown

```
* This is {first}.
1. The value is {1}.
2. The value is zero.
3. The value is zero.
* This is last.
```

marky transforms the Markdown into Python source code. Execution of the Python source code yields the new Markdown text.

#### Output: build/file.py

```
___(rf""* This is {{first}}. "", ___);
x = 1 # this is code
for i in range(3):
    if x:
        ___(rf""
{i+1}. The value is {{x}}.
"", ___);
```

```

    else:
        ___(rf""{i+1}. The value is zero.
""", ___);
    x = 0
___(rf""* This is last.
""", ___);

```

## 2 Quick Start

### 2.1 marky Dependencies

marky depends on `pandoc` and `pyyaml`. `pandoc` is used for rendering the Markdown into `html` and `pdf`. marky uses `pandoc` for rendering `html` and `pdf`. `pandoc`>=2.10 releases can be found [here](#). The other packages can be installed with `pip`.

```

pip install pandoc-fignos
pip install pandoc-eqnos
pip install pandoc-secnos
pip install pandoc-tablenos
pip install pandoc-xnos
pip install pyyaml

```

### 2.2 marky Workflow

Workflow for creating `html` or `pdf` using marky by invocation of `make scan` and `make all`.

<i>make</i>	1. <i>write</i>	2. <i>build</i>	3. <i>render</i>
<code>pdf</code>		<code>build/file.html.md</code>	<code>-&gt; html/file.html</code>
<code>-</code>	<code>md/file.md</code>	<code>-&gt;</code>	
<code>hfml</code>		<code>build/file.pdf.md</code>	<code>-&gt; pdf/file.pdf</code>

1. **write**: user writes a Markdown text file and places it in `md/*.md` directory with the extension `.md`.
2. **build**: marky transforms the files in `md/*.md` into regular Markdown text and places the transformed files in `build/`.
3. **render**: the regular Markdown text in the files `build/*.md` is rendered into `html` and `pdf` using `pandoc`.

The three steps are implemented in a Makefile.

## 2.3 Download and Initialize

`marky` is supplied as a single-file script which automatically sets up the project structure containing all scripts required for processing and rendering Markdown.

For example, download `marky` from github.

```
git clone https://lehmann7.github.com/marky.git
cd marky
```

After download, the `marky` environment is initialized using `marky`.

```
./marky.py --init
# mkdir build/
# mkdir data
# mkdir md/
# WRITE Makefile
# WRITE pandoc-run
# WRITE md/marky.md
# WRITE .gitignore
# USAGE
make help
```

## 2.4 `marky` Environment

During initialization, `marky` creates directories and files. After initialization, the following structure is auto-generated in the project directory. `marky` shows the project structure when invoking `make tree`.

```
PROJECT TREE
#####
<working_dir>
|- marky.py           - marky executable
|- Makefile           (*) - marky Makefile
|- pandoc-run         (*) - pandoc wrapper
|- md/                (*) - user Markdown dir
|   |- *.md           - user Markdown text
|- data/              (*) - user data dir
|   |- *.             user data files
|- build/             (*) - build Markdown dir
|   |- *.py           (*) - marky Python code
```



```
| | - *.make      (*) - Makefile rules
| | - *.html.md   (*) - Markdown for html format
| | - *.pdf.md    (*) - Markdown for pdf format
|- html/*.html    (*) - rendered html dir
|- pdf/*.pdf      (*) - rendered pdf dir
```

```
(*) directories/files are auto-generated using
    `./marky.py --init; make scan; make all`
```

The script `pandoc-run` can be adjusted in case specific `pandoc` options are required for rendering the `html` and `pdf` documents.

## 2.5 Document Rendering

By invoking `make all` all files `md/*.md` are transformed into corresponding `html/*.html` and `pdf/*.pdf` files. By invoking `make httpd` a python web server is started in `html/`.

All user-generated Markdown content goes into `md/*` user-generated data files go into `data/*`.

**ATTENTION:** The files in the directories `build/*` are **auto-generated**. All user files have to be placed inside the directory `md/*`. Invoking `make clean` will **delete all files** in `html/`, `build/` and `pdf/`.

## 2.6 marky Makefile Targets

`marky` manages all files using Makefile targets. Makefile targets are initialized using `make scan` and shown using `make list`.

```
marky TARGETS
#####
make scan/<ALIAS> - create Makefile `build/<ALIAS>.make`
make build/<ALIAS> - build `build/<ALIAS>.{html,pdf}.md,py`
make html/<ALIAS> - build `html/<ALIAS>.html`
make pdf/<ALIAS> - build `pdf/<ALIAS>.pdf`
make tex/<ALIAS> - build `pdf/<ALIAS>.tex`
make aux/<ALIAS> - run aux commands for <ALIAS>
make clean/<ALIAS> - clean files, keep: `make,html,pdf,tex`
```

```
<ALIAS>
#####
fmtplot marky
```

## 2.7 Integrated Documentation

marky has an integrated environment. Using `make help` displays a short info about the marky dependencies, make targets and examples.

```
marky DEPENDENCIES
#####
* pandoc >= 2.10
* pip install pandoc-fignos
* pip install pandoc-eqnos
* pip install pandoc-secnos
* pip install pandoc-tablenos
* pip install pandoc-xnos
* pip install pyyaml

ATTENTION
#####
All files in `build/*.md` and `html/*.html` are auto-generated!
User files `*.md` have to be placed in `md/*.md`!
`make clean` deletes all files in `build/`, `html/` and `pdf/`.

marky UTILS
#####
* make help          - show this *Help Message*
* make tree          - show the *Project Tree*
* make httpd         - run python -m httpd.server in `html/`
* make clean         - delete: `build/*`, `html/*`, `pdf/*`
* make quiet [...]   - build with `./marky --quiet [...]`
* make list          - list all scanned files and targets

marky BUILD ALL
#####
* make scan          -> `build/*.make`
```

```

* make build      -> `build/*.{html,pdf}.md`
* make tex        -> `build/*.tex`
* make html       -> `html/*.html`
* make pdf        -> `pdf/*.pdf`
* make tex        -> `build/*.tex`
* make aux        -> run all aux commands
* make all        -> `html/*.html`, `pdf/*.pdf`

marky BUILD FILE
#####
* make scan/file  -> `build/file.make`
* make build/file -> `build/file.{html,pdf}.md,py`
* make tex/file   -> `build/file.tex`
* make html/file  -> `html/file.html`
* make pdf/file   -> `pdf/pdf.pdf`
* make aux/file   -> run aux commands for file
* make clean/file -> clean, but keep `make,pdf,html,tex`

```

#### EXAMPLE

```

#####
1. run `make scan; make html/file.html httpd`:
    * generate `build/file.make`
    * transform `md/file.md` -> `html/file.html`
    * start a python httpd server in `html`
2. run `make scan; make pdf/file.pdf`
    * generate `build/file.make`
    * transform `md/file.md` -> `pdf/file.pdf`
3. run `make scan; make list`: list all targets

```

## 3 marky Features

In order to quick start a new Markdown project, just link the marky.py executable in the project dir or clone the git as described above, and initialize the environment using `--init`.

```

mkdir my_project
cd my_project
ln -s ~/marky/marky.py .

```

```
# ... or git clone ...
```

```
./marky.py --init
```

Now marky is ready for operation. Place a new file in `md/file.md` and run the following commands.

```
touch md/file.md
```

```
make scan
```

```
# WRITE build/file.make
```

marky discovers the new document when invoking `make scan`. marky also renders `html` and `pdf` using make targets.

```
make html/file
```

```
make pdf/file
```

### 3.1 Meta Data in Front Matter

If document starts with `---`, `yaml` is used to parse the front matter block delimited by `---`. All meta data keys will be exposed into the python scope as a local variable, unless the variable already exists.

#### Example

```
---
```

```
title: "`marky` Documentation "
```

```
author: ...
```

```
date: 2022-01-01
```

```
---
```

The title of this document is `{{title}}`.

#### Output

```
---
```

```
title: "`marky` Documentation "
```

```
author: ...
```

```
date: 2022-01-01
```

```
---
```

The title of this document is ``marky` Documentation .`

### 3.2 Inline Formatted Output

Python local variables and variables from meta data in front matter can be accessed directly from the markdown text. The `{{...}}` statement uses syntax similar to python f-strings for formatted output of variables and results of expressions into Markdown text. The `marky` operator `{{<expression>[:<format>]}}` uses the syntax of f-strings.

#### Example 1

Title of this document is `{{title}}` and font size is `{{fontsize}}`.  
``x`` is `{{x}}` and `{{",".join([str(i) for i in range(x-10,x)])}}`.

#### Output

Title of this document is `marky Documentation` and font size is 11pt. `x` is 0 and -10,-9,-8,-7,-6,-5,-4,-3,-2,-1.

#### Example 2

```
x = int(1)
y = float(2.3)
z = 0
a = [1, 2, 3]
b = (4, 5)
```

This is a paragraph and `x` is `{{x:03d}}` and `y` is `{{y:.2f}}`.  
Other content is: `a = {{a}}`, `b = {{b}}`.

#### Output

This is a paragraph and `x` is 001 and `y` is 2.30. Other content is:  
`a = [1, 2, 3]`, `b = (4, 5)`.

### 3.3 Embedding Python Code

Python code blocks are embedded into Markdown using `<?...?>` and `{{...}}`. All code blocks span one large scope sharing functions and local variables. Meta data is imported from Markdown front matter as local variables in the python scope. The `import` statement can be used in python code in order to access installed python packages as usual.

### 3.3.1 Visible Code

Using `<?!...?>` code is executed and stored. The text of the last `<?!...?>` block can be accessed and placed via `{{__(code=True)}}`.

#### Example

```
<?!  
x = 42 # visible code  
print("Hello console!")  
?>  
{{__(code=True)}}
```

#### Run and Output

```
x = 42 # visible code  
print("Hello console!")
```

**ATTENTION:** Using the `print()` function the text will be printed to the console and **not** inside the resulting Markdown text.

### 3.3.2 Hidden Code

Using `<?...?>` code is executed but not shown in Markdown.

#### Example

```
<?  
x = 41 # hidden code  
__(f"Output to Markdown. x = {x}!")  
?>
```

#### Run and Output

```
Output to Markdown. x = 41!
```

**ATTENTION:** Using the `__()` function the text will be printed inside the resulting Markdown text **and not** on the console.

### 3.3.3 Error Messages

marky shows error messages directly inside the Markdown text.

**Example: md/file.md**

```
1 ---
2 title: "My Document"
3 ---
4 <?
5 x = 1
6 ?>
7 The value x is {{y}}.
```

**Run and Output: make build/file**

```
<!-- run md/file.md --!>
<!-- run build/file.py --!>
<!-- PYTHON ERROR
File "md/file.md", line 7, in <module>
    The value x is {{y}}.
Error <class 'NameError'> : name 'y' is not defined
--!>
```

### 3.4 The `___()` Function

Using the `print()` statement the text will be printed to the console. When using the `___()` statement new Markdown text is inserted dynamically into the document during preprocessing.

**Example: Line Break**

```
<?
x = 40 # hidden code
___("Output in ", ___)
___("single line! ", ___)
___(f"x = {x}")
?>
```

**Run and Output**

Output in single line! x = 40

**Example: Shift, Crop, Return**

```

<?
result = ___("""
    * text is cropped and shifted
    * shift and crop
    * can be combined
    * returning the result
""", shift="#####", crop=True, ret=True)
___(result)
?>

```

### Run and Output

```

#####* text is cropped and shifted
#####      * shift and crop
#####      * can be combined
#####      * returning the result

```

### 3.5 Algorithmic Table Example

Table 1 is generated using the following python clode block.

```

n = 5
table = ""
dec = ["*%S*", "**%S**", "~%S~~", "`%S`",
       r"$\times^%s$", "$\infty_%s$"]
table += "|" .join("X"*n) + "\n" + "|" .join("-"*n) + "\n"
for i in range(n):
    fill = [chr(ord("A")+(2*i+3*k)%26) for k in range(i+1)]
    fill = [dec[(l+i)%len(dec)]%k for l, k in enumerate(fill)]
    text = list("0")*n
    text[(n>>1)-(i>>1):(n>>1)+(i>>1)] = fill
    table += "|" .join(text) + "\n"

```

Table 1: Table is generated using code and the `___()` statement.

X	X	X	X	X
0	0	A	0	0
0	0	C	F	0
0	E	H	$\times^K$	0
0	G	$\times^J$	$\infty_M$	P



X	X	X	X	X
$\times^I$	$\infty_L$	$O$	$\mathbf{R}$	$\mathfrak{U}$

### 3.6 Format Link Extension

When writing multiple documents, often documents are referenced between each other using links. In order to refer to external `html` and `pdf` documents the Markdown link statement is used.

```
[Link Caption](path/to/file.html)
[Link Caption](path/to/file.pdf)
```

One link statement cannot be used for rendering `html` and `pdf` with consistent paths. Using the `marky` format link `.???` file extension results in consistent links for `html` and `pdf` documents.

#### Example

```
[Link to this Document](marky.???)
```

#### Output

Link to this Document

### 3.7 Format Codes

Often when writing markdown for `html` and `pdf` documents, the output needs to be tweaked accordingly. `marky` supports format specific tweaking by injecting raw `html` or `tex` code into Markdown using format codes.

In order to inject format specific code the `fmtcode` class is used. The `fmtcode` class manages injection of `html` and `tex` code depending on the output format.

**ATTENTION:** `tex` packages have to be included for `pdf` as well as JavaScript and style sheets for `html` using the meta data fields `header--includes--pdf` and `header--includes--html` respectively.

#### Example: `fmtcode`

```
F = fmtcode(html="H<sup>T</sup><sub>M</sub>L", pdf=r"\LaTeX")
```

*Invocation of format code results in:  $\{F()\}$ .*

## Output

Invocation of format code results in: L<sup>A</sup>T<sub>E</sub>X.

## Example: Color

```
C = lambda color: fmtcode(
    html="<span style='color:%s;'>{0}</span>" % color,
    pdf=r"\textcolor{{{s}}}{{{0}}}" % color
)
B = C("blue")
R = C("red")
```

Text with `{{B("blue")}}` and `{{R("RED")}}`.

## Output

Text with blue and RED.

## Example: Classes

```
class color:
    def __init__(self, color):
        self.color = color
    def upper(self, x):
        return self.text(x.upper())
    def lower(self, x):
        return self.text(x.lower())

class html(color):
    def text(self, x):
        return f"<span style='color:{self.color};'>{x}</span>"

class pdf(color):
    def text(self, x):
        return rf"\textcolor{{{self.color}}}{{{x}}}"

CC = lambda x: fmtcode(html=html(x), pdf=pdf(x))
BB = CC("blue")
RR = CC("red")
```

Text with `{{BB.upper("blue")}}` and `{{RR.lower("RED")}}`.

## Output

Text with BLUE and red.

### 3.8 Markdown Include

The `marky` include statement `___(file)` For inclusion of text from other files can be used to include text into `html` and `pdf` documents.

```
<?
___(file="include.md", __marky__=False, raw=False, aux=False)
?>
```

`___(file)` supports following options.

- `__marky__`: controls whether the include file is processed as `marky` script (`True`) or as a `marky` module (`False`, default).
- `raw`: controls whether the include file is included as-is (`True`) or processed via `marky` (`False`, default).
- `aux`: disables processing of the file if `True`, (default: `False`).

When script mode is activated (`__marky__=True`) then the *module code* as well as the *script code* are executed. However, if module mode is activated (`__marky__=False`), only the *module code* is processed.

```
---
title: Test
---
<?
# marky module code
?>
`marky` module output
<?
if __marky__:
    # marky script code
    ?>`marky` script output<?
?>
```

## 4 Meta Data in Front Matter

Meta data is annotated in the front matter of a Markdown text document. The front matter must start in the first line with `---` and precedes all other text being fenced by `---`. The meta data is in `yaml` format. The `yaml`

block is parsed using `python-pyyaml`. All meta data is imported into the preprocessed document.

## 4.1 Pandoc Front Matter

### Example

```
---
title: My Document
date: 2022-01-01
author: ...
link-citations: true
bibliography: data/marky.bib
header-includes: >
  \hypersetup{colorlinks=false,
    allbordercolors={0 0 0},
    pdfborderstyle={/S/U/W 1}}
xnos-cleveref: true
xnos-capitalise: true
fontsize: 11pt
---
```

The meta data fields `title`, `date`, `author`, `link-citations`, `bibliography` and `header-includes` are processed by `pandoc` during document rendering. `fontsize` adjusts the font size in `html` and `pdf` documents. The `xnos-cleveref` and `xnos-capitalise` fields are used by the `pandoc-xnos` extensions for referencing figures, tables, sections and equations.

## 4.2 marky Format Fields

### Example: `md/file.md`

```
---
header-includes--pdf: >
  \hypersetup{
    colorlinks=false,
    allbordercolors={0 0 0},
    pdfborderstyle={/S/U/W 1}}
header-includes--html: >
  <style>* { box-sizing: border-box; }</style>
---
```

The pandoc `header-includes` field is used for `pdf` and `html` documents, therefore it must contain corresponding `tex` and `html` code.

The field `header-includes` ending with `--pdf` or `--html` specifies corresponding options for the generation of `pdf` and `html` documents. During `make`, `marky` scans all meta data fields, and fields which end with `--pdf` and `--html` are selected and forwarded to `pandoc` based on the format to be rendered.

After `build make build/file` the meta data field `header-includes` is present in the files `build/file.html.md` and `build/file.pdf.md` accordingly.

**Example: `build/file.html.md`**

```
-----
header-includes: >
  <style>* { box-sizing: border-box; }</style>
-----
```

**Example: `build/file.pdf.md`**

```
-----
header-includes: >
  \hypersetup{
    colorlinks=false,
    allbordercolors={0 0 0},
    pdfborderstyle={/S/U/W 1}}
-----
```

## 5 Scientific Writing in Markdown

Markdown is a markup language for technical writing, with emphasis on readability. Markdown can be rendered in many formats including `html` and `pdf` by using `pandoc` for example.

Using various Markdown extensions of `pandoc` a sufficient structure for writing scientific documents is reflected using Markdown syntax. `marky` by default uses the following `pandoc` Markdown extensions.

- parsing extensions
  - `all_symbols_escapable`

- intraword\_underscores
  - escaped\_line\_breaks
  - space\_in\_atx\_header
  - lists\_without\_preceding\_blankline
- styling extensions
  - inline\_code\_attributes
  - strikeouts
- structuring extensions
  - yaml\_metadata\_block
  - pipe\_tables
  - line\_blocks
  - implicit\_figures
  - abbreviations
  - inline\_notes
- code injection
  - raw\_html
  - raw\_tex

pandoc supports equations rendered inline and single-line in tex-style using  $\dots$  and  $\dots$ , bibliography using the `--citeproc` option, section numbering using the `--number-sections` option and table of contents using the `--table-of-contents` option.

pandoc supports xnos filters for referencing document content like figures, equations, tables, sections by using the `--filter pandoc-xnos` option. xnos integrates clever references, which means “Fig.”, “Sec.”, “Eq.” and “Tab.” are added automatically to the corresponding element. If the prefix is to be omitted, the reference is written as `\!@ref:label`.

## Example

```
## Referenced Section {#sec:label}
```

This is a reference to @sec:label.

```
![This is the caption](
UhEUgAAAAUAAAAFCAYAAACNbyblAAAAHE1EQVQI12P4//8/w38GIAXDIBKEODH
xgljNBAAO9TXLOy4OHwAAAABJRu5ErkJggg==){#fig:label}
```

This is a reference to @fig:label.

A	B	C	D
---	---	---	---
000	111	444	555
222	333	666	777

Table: This is the caption `{#tbl:label}`

This is a reference to `@tbl:label`.

$$e^{i\pi} + 1 = 0$$
 `{#eq:label}`

This is a reference to `@eq:label`.

This is a citation `[@Muller1993]`.

The file `marky.bib` is specified in the meta data in the front matter of the Markdown text.

## 5.1 Referenced Section

This is a reference to Section 5.1.



Figure 1: This is the caption

This is a reference to Fig. 1.

Table 2: This is the caption.

A	B	C	D
000	111	444	555
222	333	666	777

This is a reference to Table 2.

$$e^{i\pi} + 1 = 0 \tag{1}$$

This is a reference to Eq. 1.

This is a citation (Muller 1993).

---

*Thanks for reading, please try marky.*

---

## References

Muller, Peter. 1993. “The Title of the Work.” *The Name of the Journal* 4 (2): 201–13.