Evolution of TC39 Proposals

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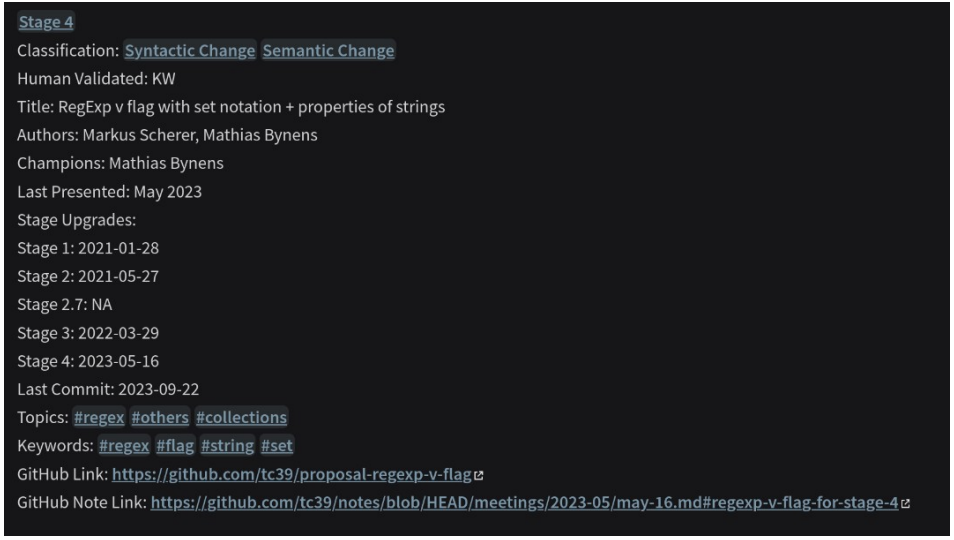
Project Aims

- Collect proposal data
  - Snapshot from Feb 2025
  - From TC39/proposals repositories
- Classify proposals
  - Stage
  - Type of change
  - Topics and keywords
  - Present on website
- Analyse evolution of proposals
  - Pattern in stage bumps?
  - Pattern in stage duration?
  - Topic dependent?
  - Time dependent?



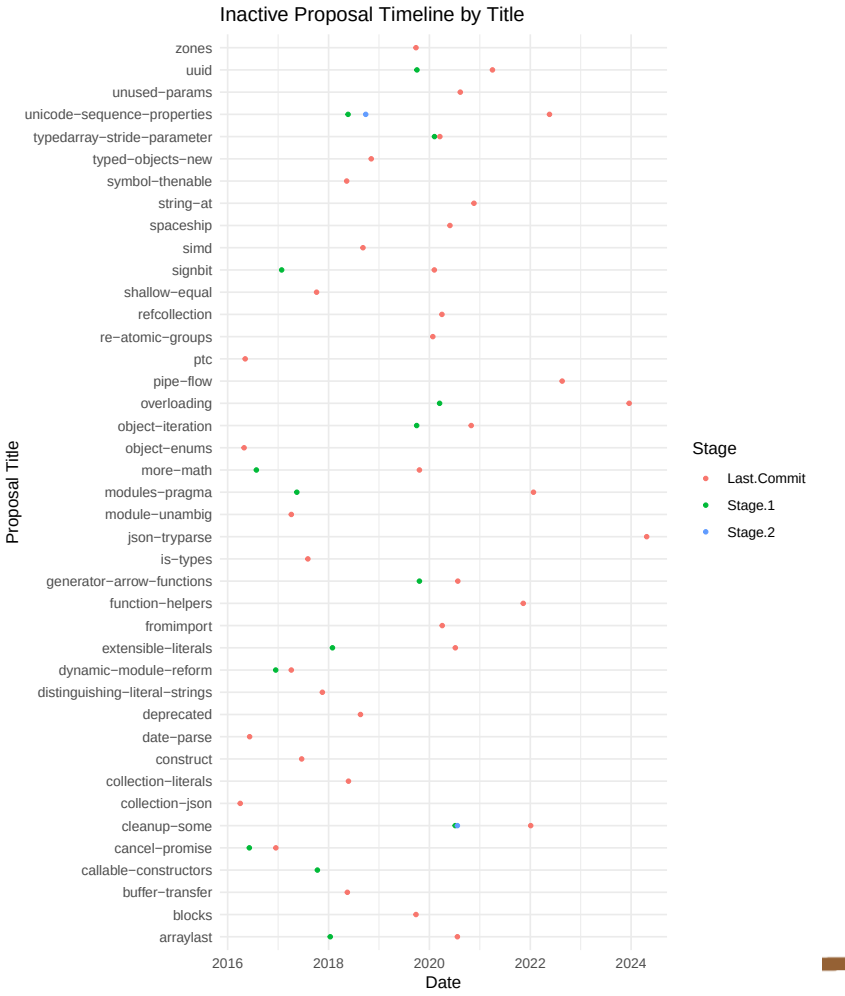
https://js-proposals.vercel.app/

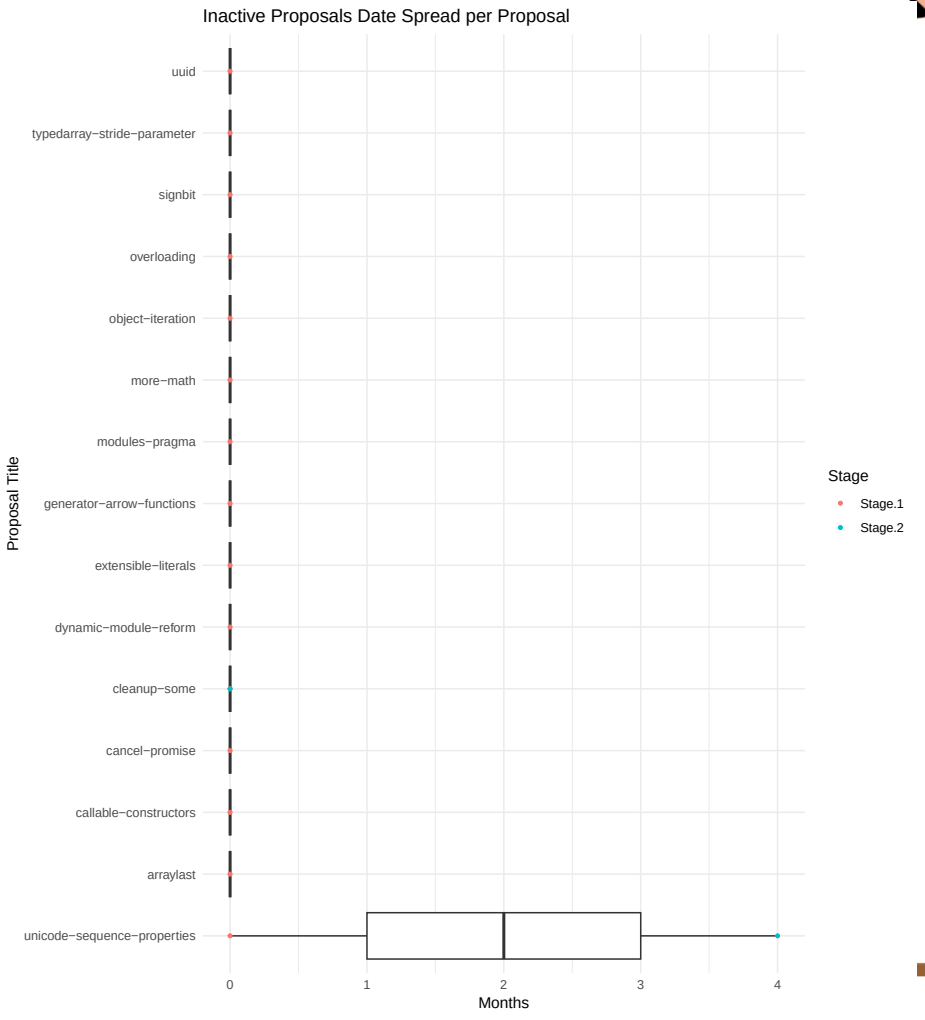
How?

- Data:
  - Retrieve data via Github API – TC39/Proposals
  - Parse the data, create .md files and saved in Obsidian
  - GPT assistance – Classifications, Stage bumps from commit messages, keywords
  - Manually verified and curated
  - Data analysis done in R and Rstudio
- Website:
  - Quartz: Open source static page generator with Obsidian compatibilty
  - Demonstration

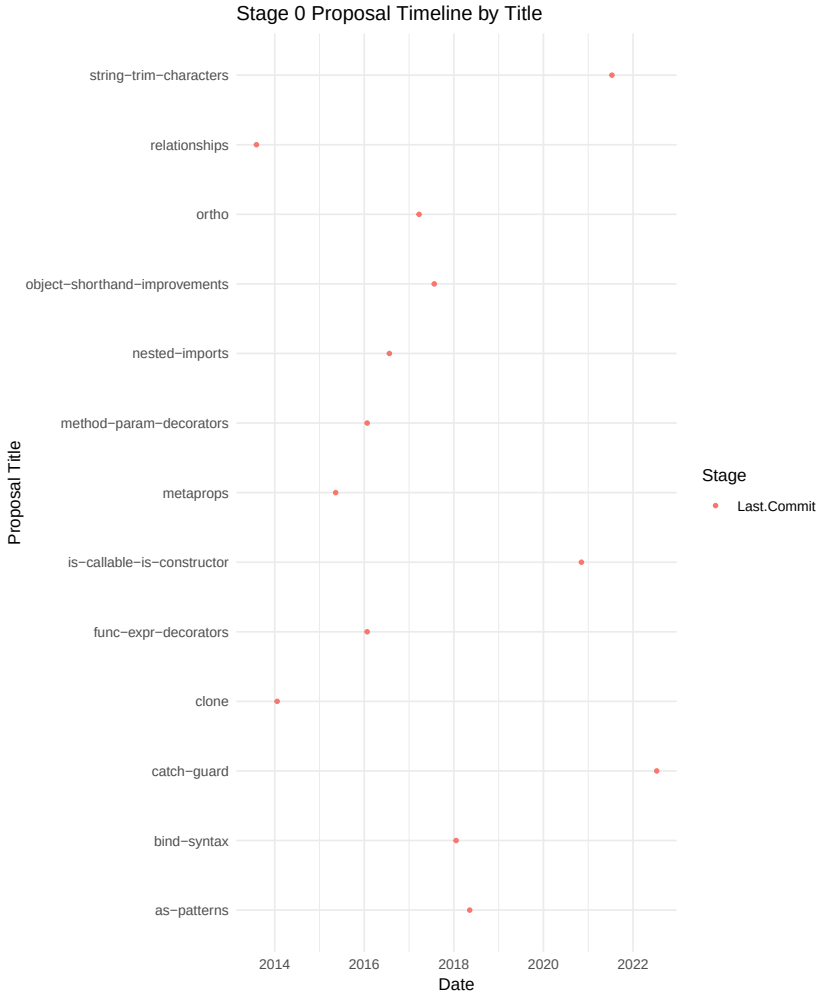
Observations

Inactive

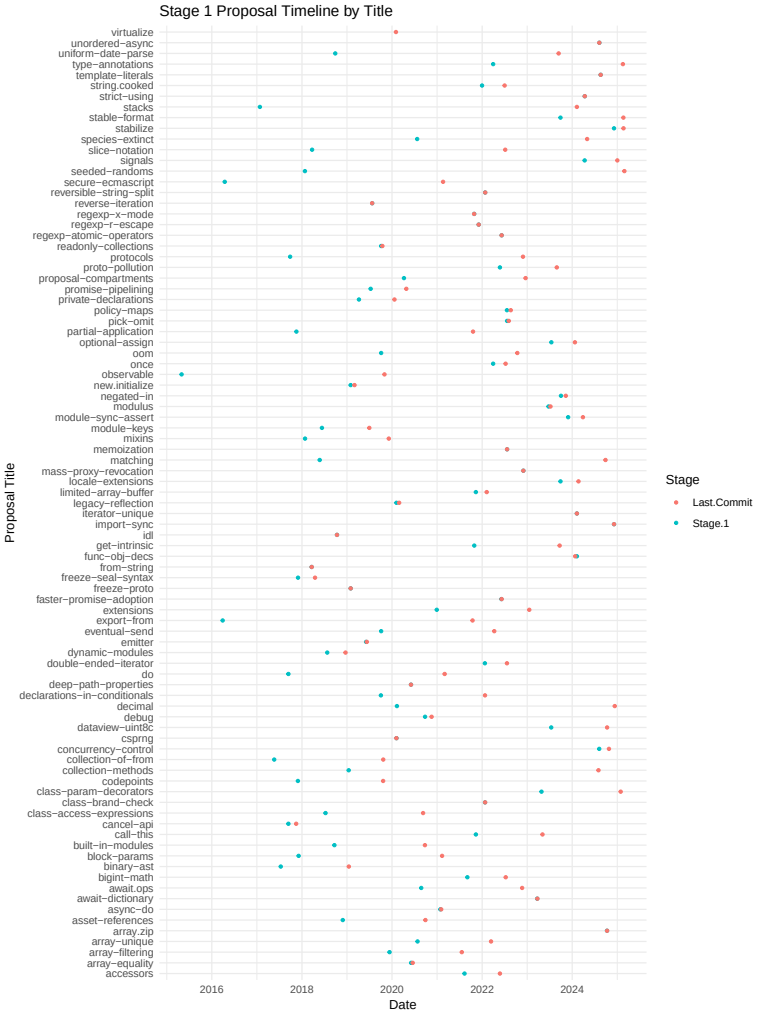

Inactive Proposal Timeline by Title
zones
uuid
unused−params
unicode−sequence−properties
typedarray−stride−parameter
typed−objects−new
symbol−thenable
string−at
spaceship
simd
signbit
shallow−equal
refcollection
re−atomic−groups
ptc
pipe−flow
overloading
object−iteration
object−enums
more−math
modules−pragma
module−unambig
json−tryparse
is−types
generator−arrow−functions
function−helpers
fromimport
extensible−literals
dynamic−module−reform
distinguishing−literal−strings
deprecated
date−parse
construct
collection−literals
collection−json
cleanup−some
cancel−promise
callable−constructors
buffer−transfer
blocks
arraylast
Proposal Title
2016
2018
2020
2022
2024
Date
Stage
Last.Commit
Stage.1
Stage.2


Inactive Proposals Date Spread per Proposal
uuid
typedarray−stride−parameter
signbit
overloading
object−iteration
more−math
modules−pragma
generator−arrow−functions
extensible−literals
dynamic−module−reform
cleanup−some
cancel−promise
callable−constructors
arraylast
unicode−sequence−properties
Proposal Title
0
1
2
3
4
Months
Stage
Stage.1
Stage.2

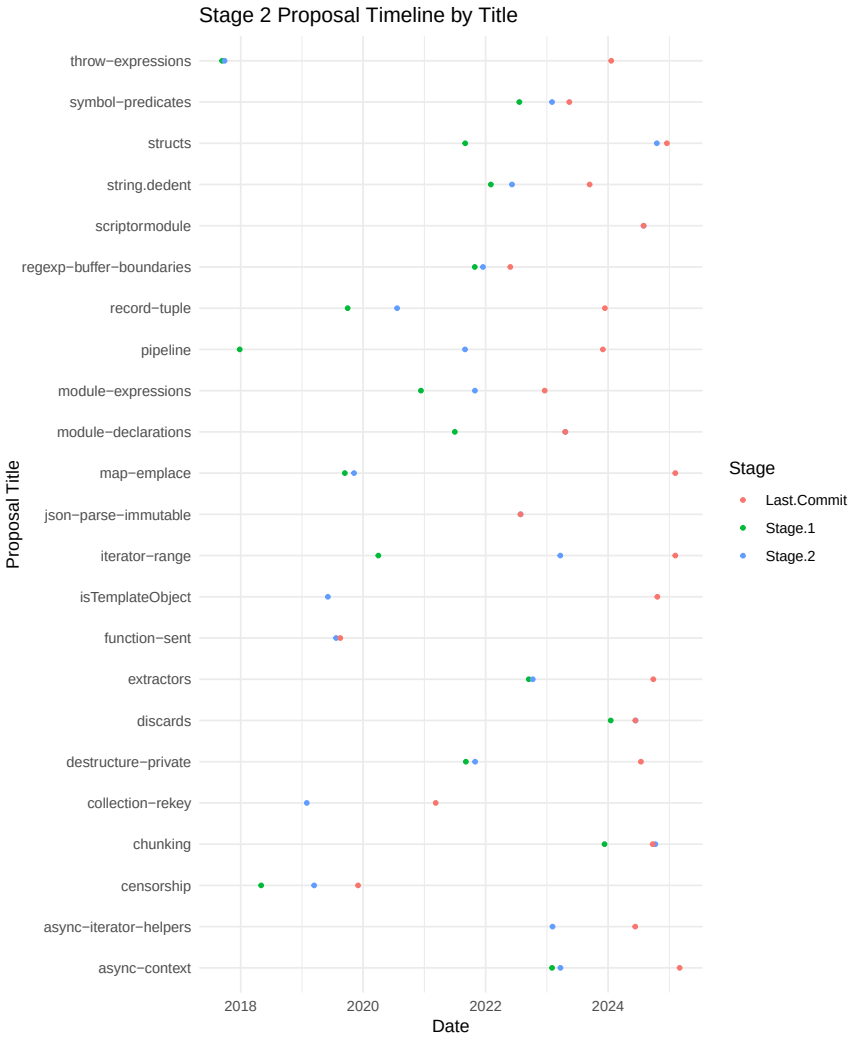
Stage 0

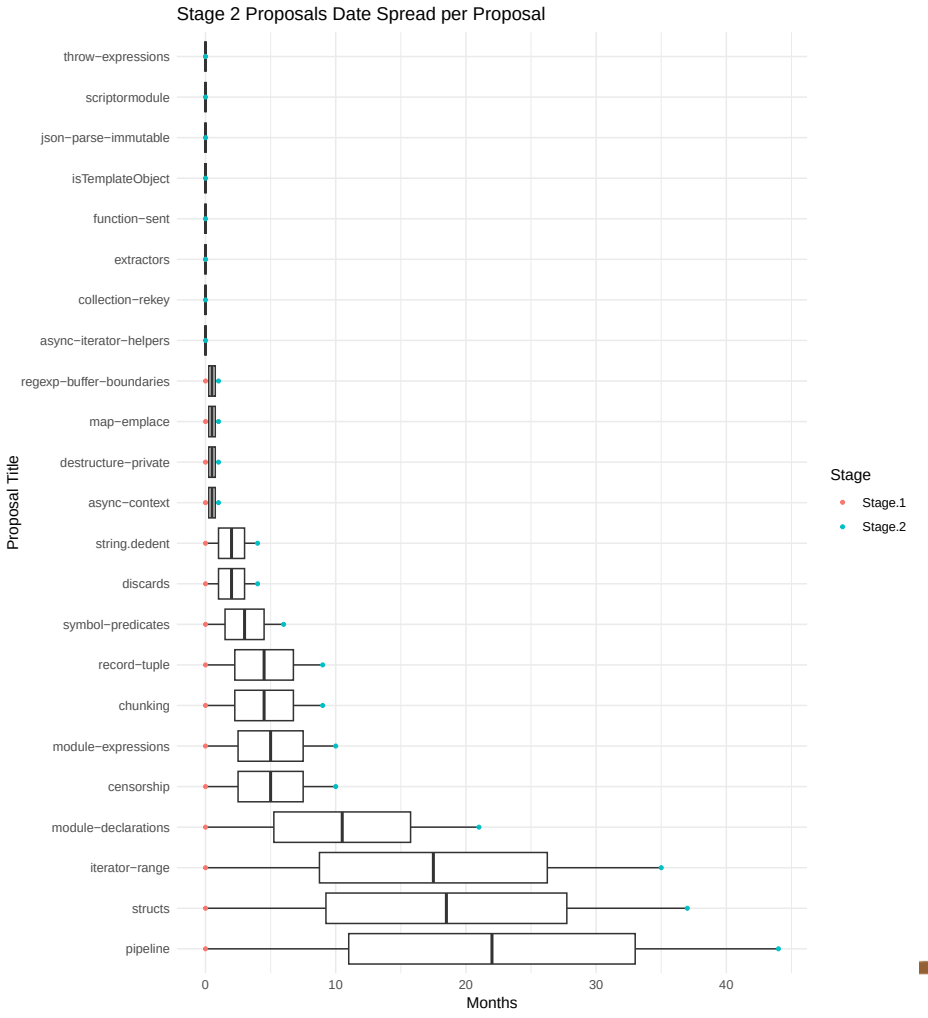


Stage 1

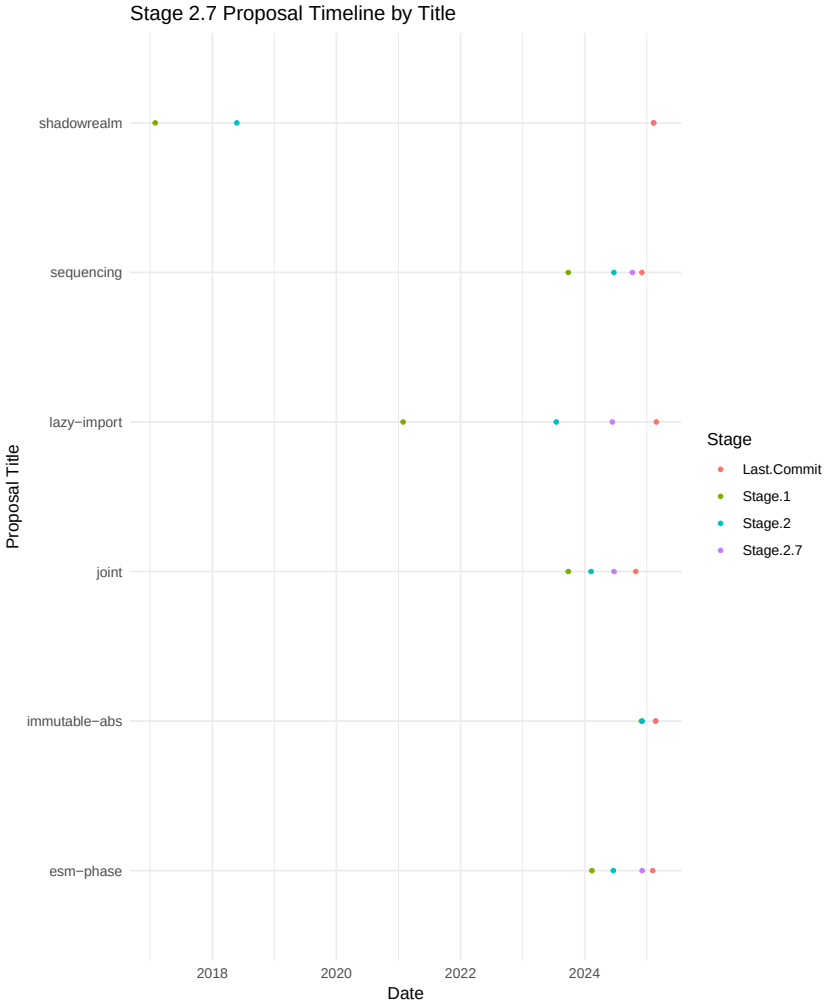


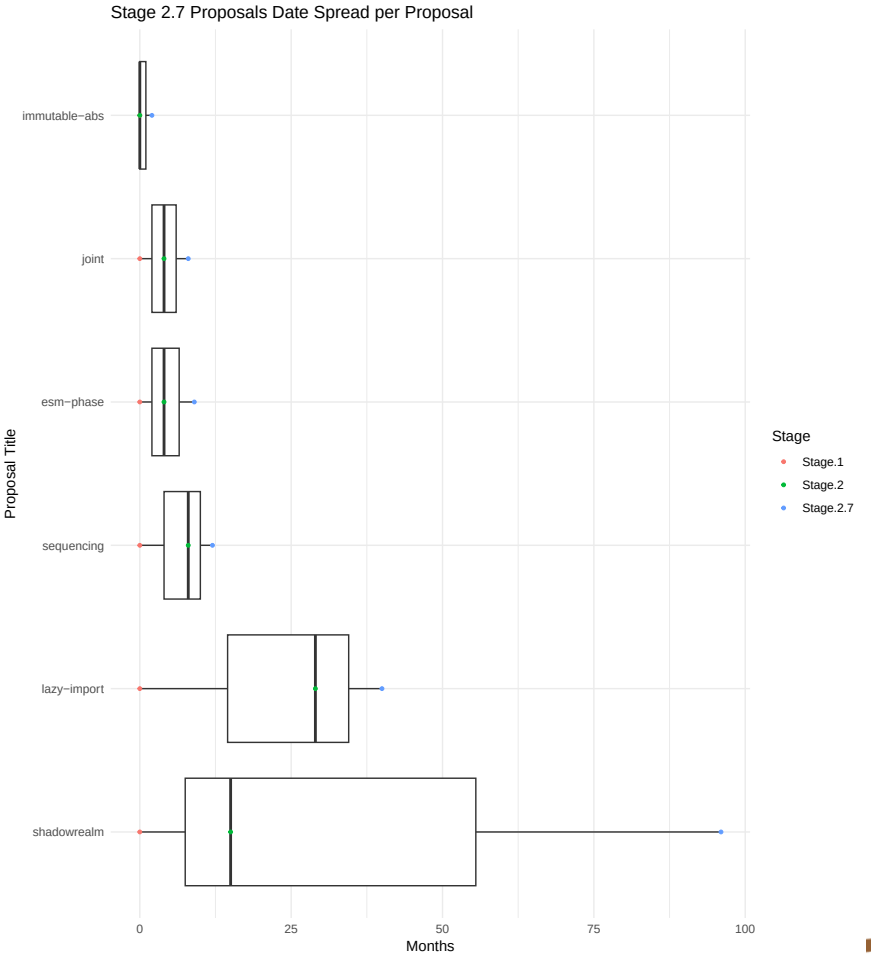
Stage 2


Stage 2 Proposal Timeline by Title
throw−expressions
symbol−predicates
structs
string.dedent
scriptormodule
regexp−buffer−boundaries
record−tuple
pipeline
module−expressions
module−declarations
map−emplace
json−parse−immutable
iterator−range
isTemplateObject
function−sent
extractors
discards
destructure−private
collection−rekey
chunking
censorship
async−iterator−helpers
async−context
Proposal Title
2018
2020
2022
2024
Date
Stage
Last.Commit
Stage.1
Stage.2

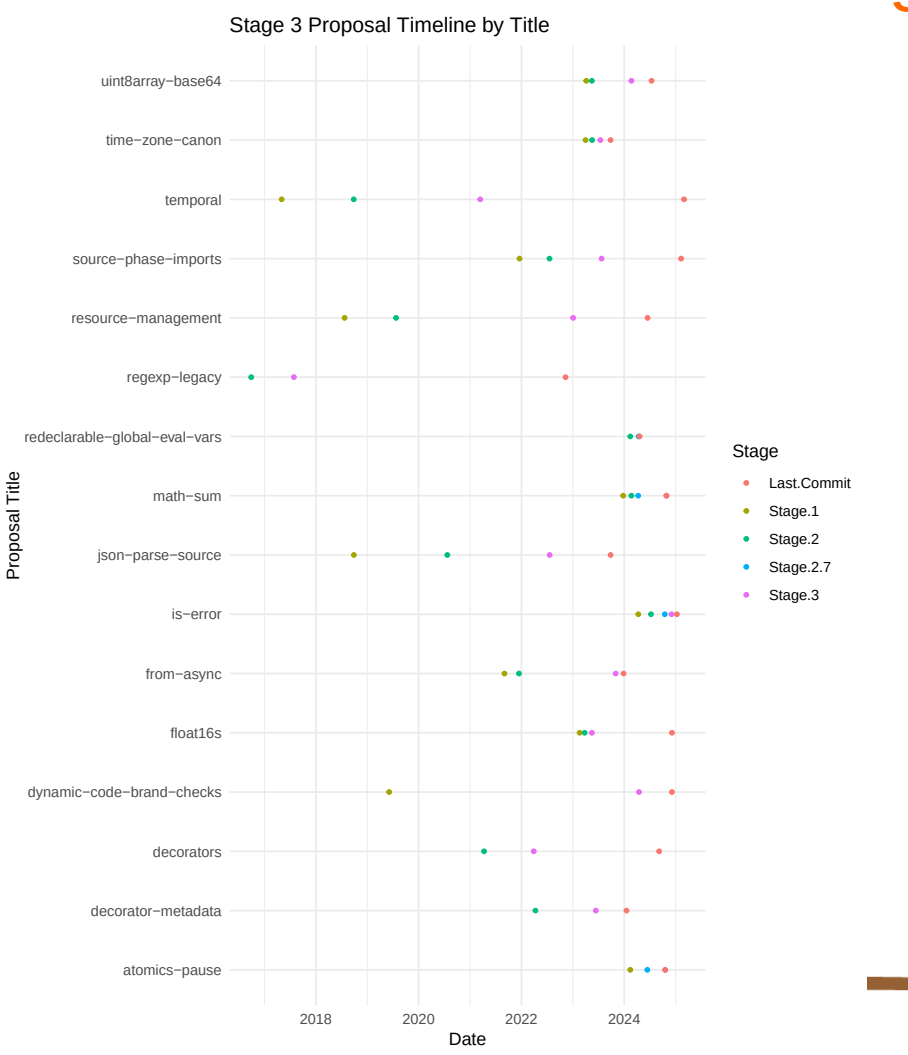

Stage 2 Proposals Date Spread per Proposal
throw−expressions
scriptormodule
json−parse−immutable
isTemplateObject
function−sent
extractors
collection−rekey
async−iterator−helpers
regexp−buffer−boundaries
map−emplace
destructure−private
async−context
string.dedent
discards
symbol−predicates
record−tuple
chunking
module−expressions
censorship
module−declarations
iterator−range
structs
pipeline
Proposal Title
0
10
20
30
40
Months
Stage
Stage.1
Stage.2

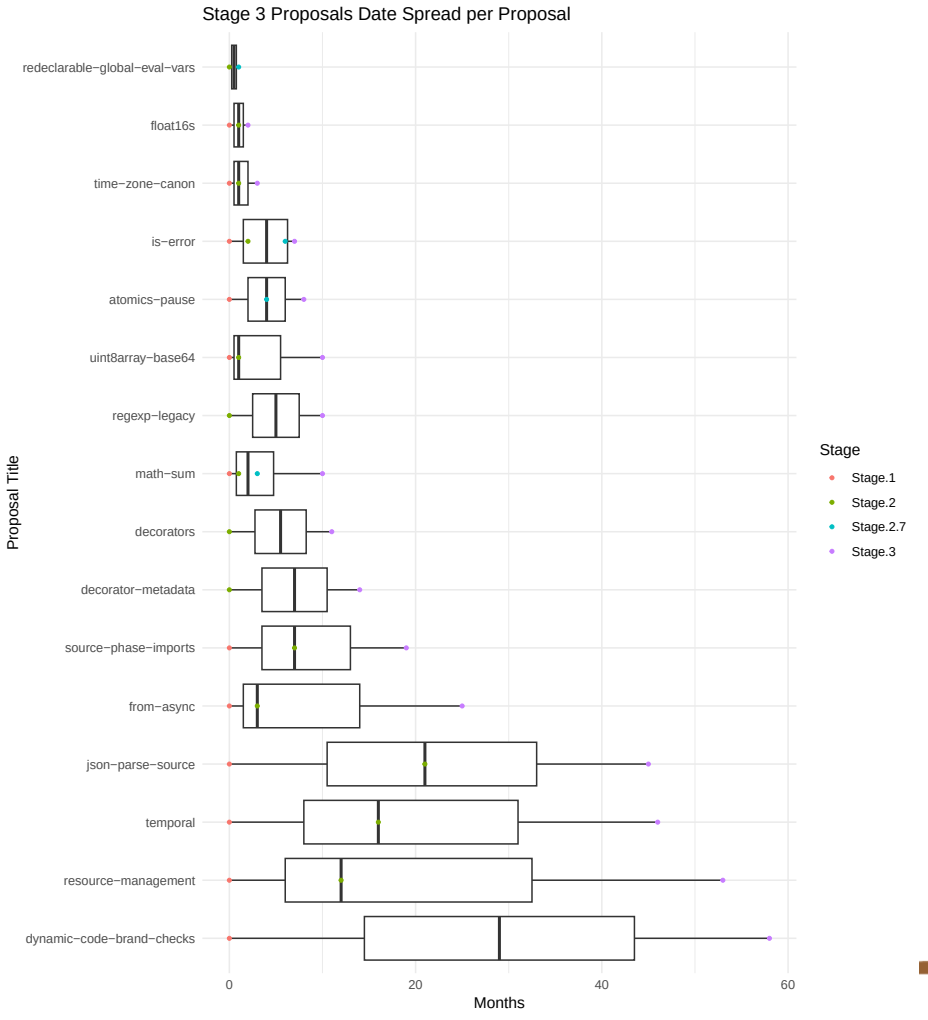
Stage 2.7


Stage 2.7 Proposal Timeline by Title
shadowrealm
sequencing
lazy−import
joint
immutable−abs
esm−phase
Proposal Title
2018
2020
2022
2024
Date
Stage
Last.Commit
Stage.1
Stage.2
Stage.2.7

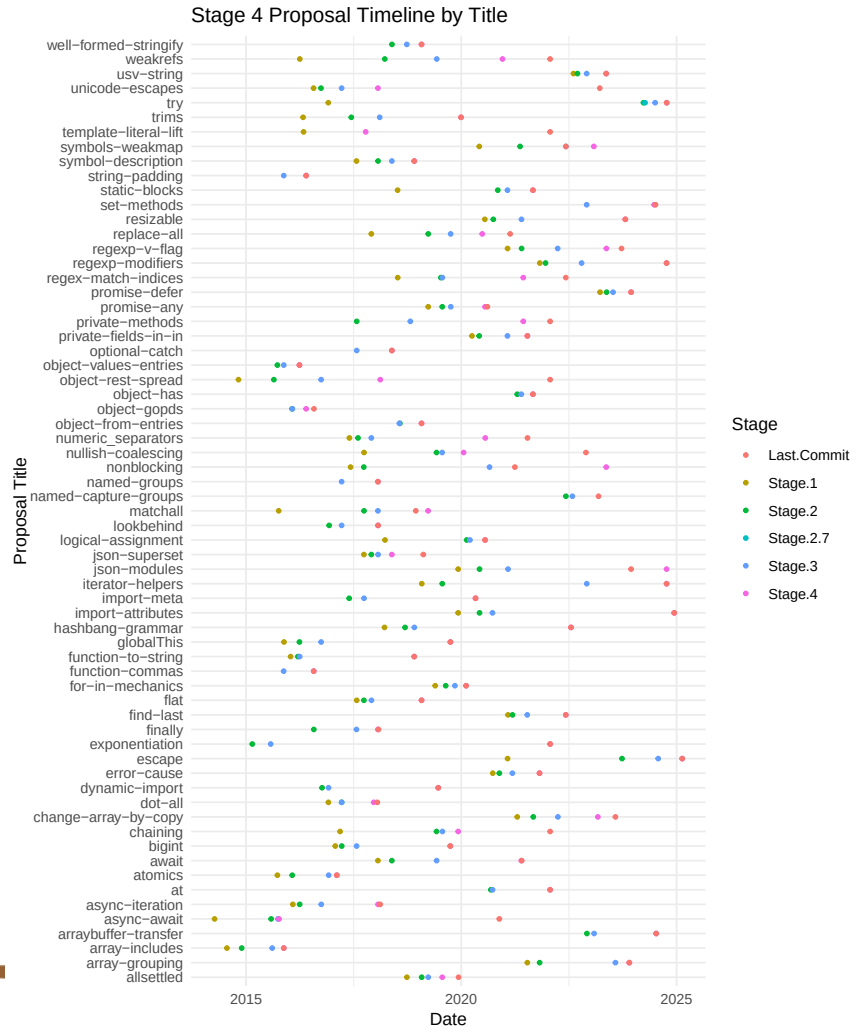

Stage 2.7 Proposals Date Spread per Proposal
immutable−abs
joint
esm−phase
sequencing
lazy−import
shadowrealm
Proposal Title
0
25
50
75
100
Months
Stage
Stage.1
Stage.2
Stage.2.7

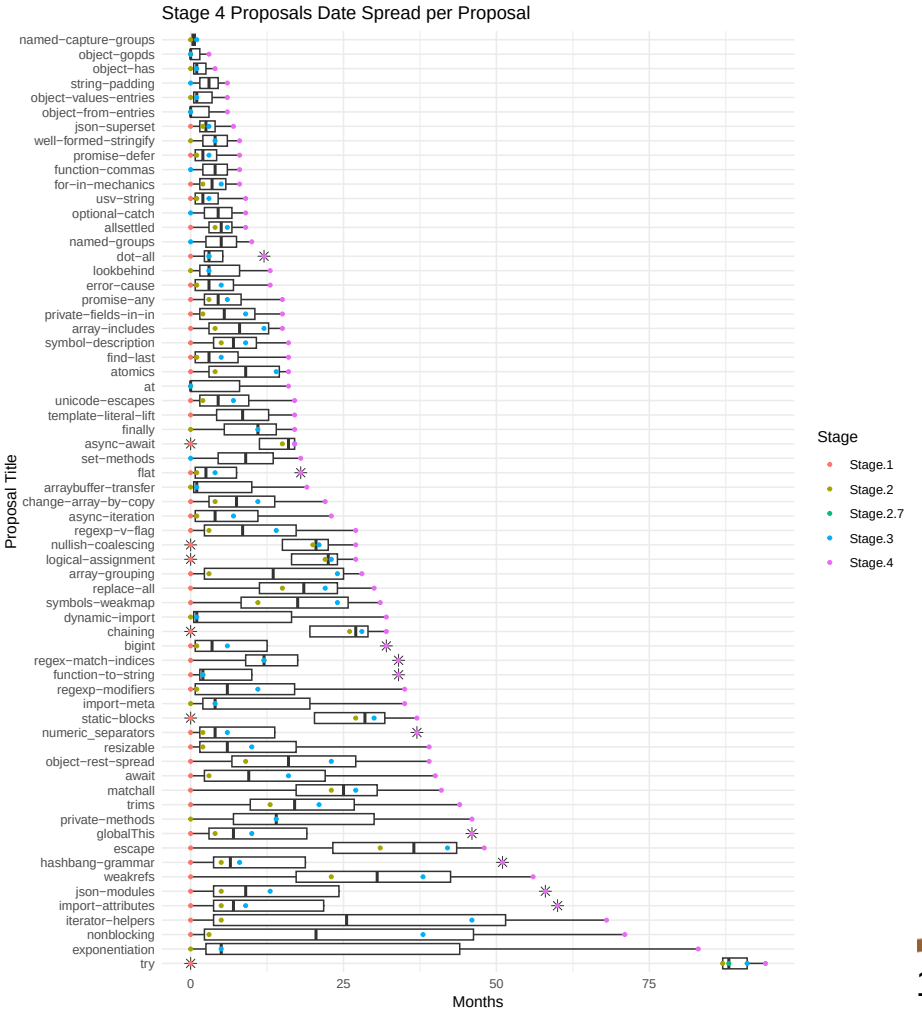
Stage 3


Stage 3 Proposal Timeline by Title
uint8array−base64
time−zone−canon
temporal
source−phase−imports
resource−management
regexp−legacy
redeclarable−global−eval−vars
math−sum
json−parse−source
is−error
from−async
float16s
dynamic−code−brand−checks
decorators
decorator−metadata
atomics−pause
Proposal Title
2018
2020
2022
2024
Date
Stage
Last.Commit
Stage.1
Stage.2
Stage.2.7
Stage.3


Stage 3 Proposals Date Spread per Proposal
redeclarable−global−eval−vars
float16s
time−zone−canon
is−error
atomics−pause
uint8array−base64
regexp−legacy
math−sum
decorators
decorator−metadata
source−phase−imports
from−async
json−parse−source
temporal
resource−management
dynamic−code−brand−checks
Proposal Title
0
20
40
60
Months
Stage
Stage.1
Stage.2
Stage.2.7
Stage.3

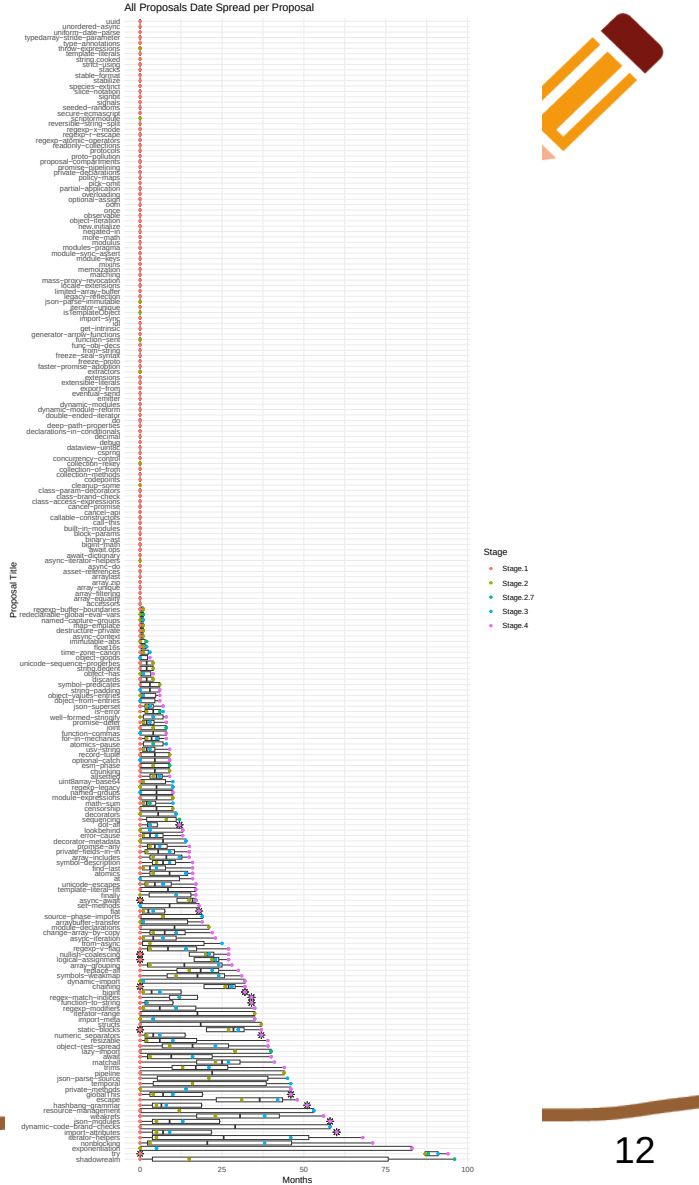
Stage 4


Stage 4 Proposal Timeline by Title
well−formed−stringify
weakrefs
usv−string
unicode−escapes
try
trims
template−literal−lift
symbols−weakmap
symbol−description
string−padding
static−blocks
set−methods
resizable
replace−all
regexp−v−flag
regexp−modifiers
regex−match−indices
promise−defer
promise−any
private−methods
private−fields−in−in
optional−catch
object−values−entries
object−rest−spread
object−has
object−gopds
object−from−entries
numeric_separators
nullish−coalescing
nonblocking
named−groups
named−capture−groups
matchall
lookbehind
logical−assignment
json−superset
json−modules
iterator−helpers
import−meta
import−attributes
hashbang−grammar
globalThis
function−to−string
function−commas
for−in−mechanics
flat
find−last
finally
exponentiation
escape
error−cause
dynamic−import
dot−all
change−array−by−copy
chaining
bigint
await
atomics
at
async−iteration
async−await
arraybuffer−transfer
array−includes
array−grouping
allsettled
Proposal Title
2015
2020
2025
Date
Stage
Last.Commit
Stage.1
Stage.2
Stage.2.7
Stage.3
Stage.4


Stage 4 Proposals Date Spread per Proposal
named−capture−groups
object−gopds
object−has
string−padding
object−values−entries
object−from−entries
json−superset
well−formed−stringify
promise−defer
function−commas
for−in−mechanics
usv−string
optional−catch
allsettled
named−groups
dot−all
lookbehind
error−cause
promise−any
private−fields−in−in
array−includes
symbol−description
find−last
atomics
at
unicode−escapes
template−literal−lift
finally
async−await
set−methods
flat
arraybuffer−transfer
change−array−by−copy
async−iteration
regexp−v−flag
nullish−coalescing
logical−assignment
array−grouping
replace−all
symbols−weakmap
dynamic−import
chaining
bigint
regex−match−indices
function−to−string
regexp−modifiers
import−meta
static−blocks
numeric_separators
resizable
object−rest−spread
await
matchall
trims
private−methods
globalThis
escape
hashbang−grammar
weakrefs
json−modules
import−attributes
iterator−helpers
nonblocking
exponentiation
try
Proposal Title
0
25
50
75
Months
Stage
Stage.1
Stage.2
Stage.2.7
Stage.3
Stage.4

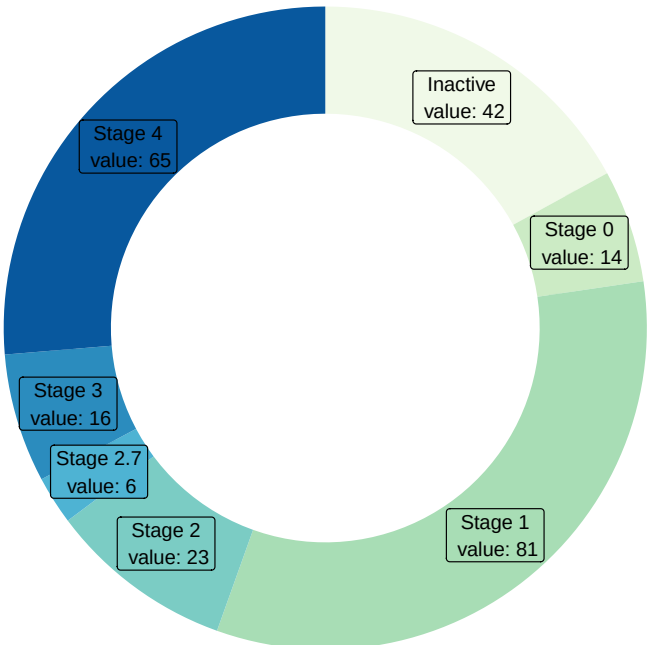
All together

What data can be extracted?
- Classifications
- Stage distribution
- Average duration per stage

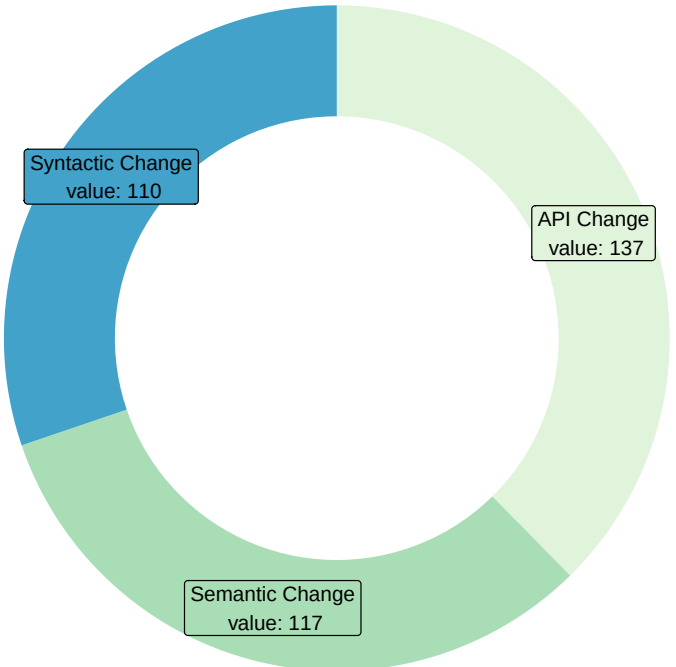


For starters

- Total number of proposals: 257



- Per Classification:

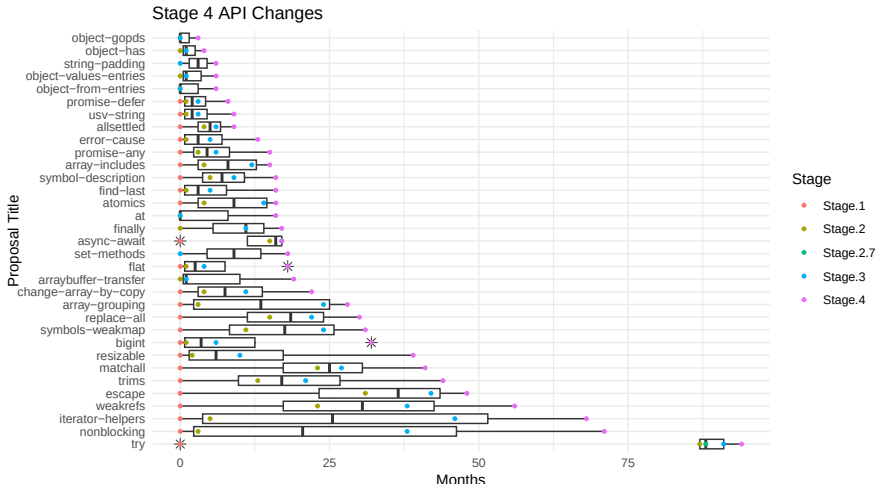


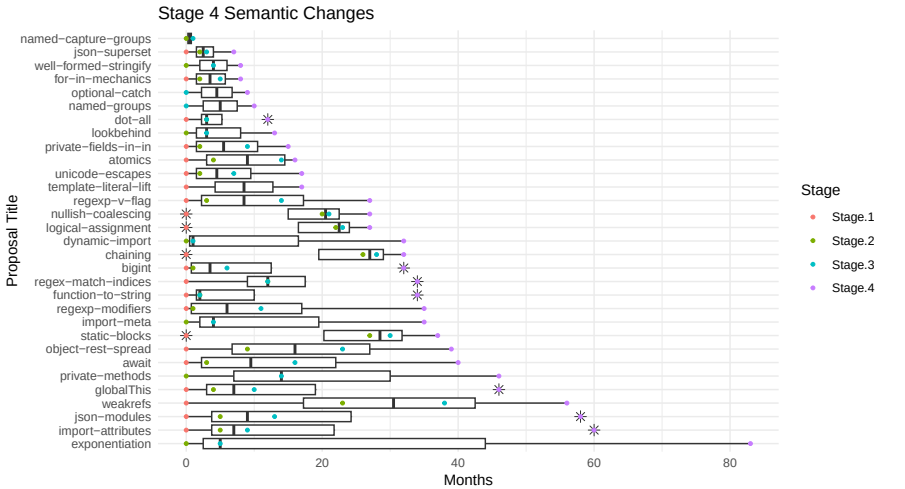
Note: Proposals can overlap classifications

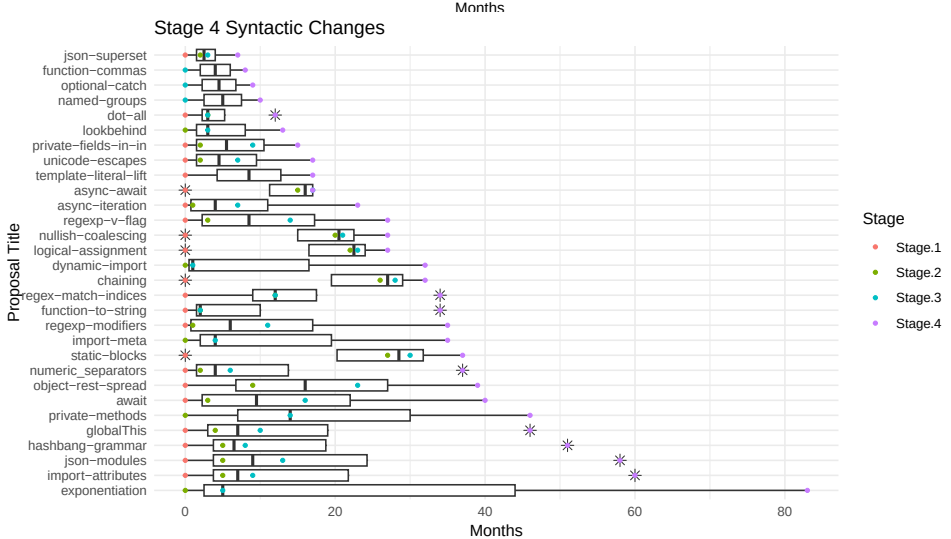
Lets look at Stage 4

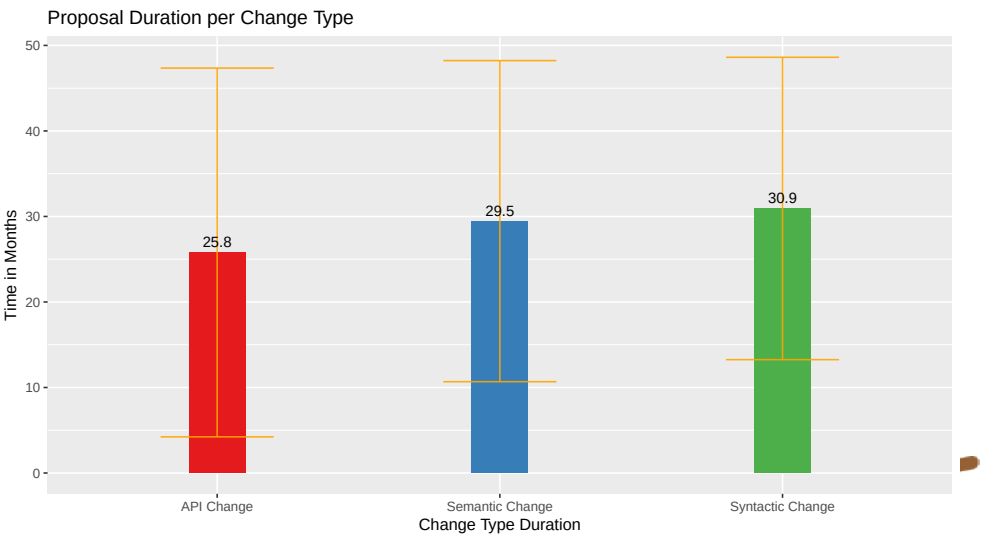
- Most complete data set
- Data gets skewed by the earlier stages

Stage 4: Average Duration per Change









Lets look at more granular classifications

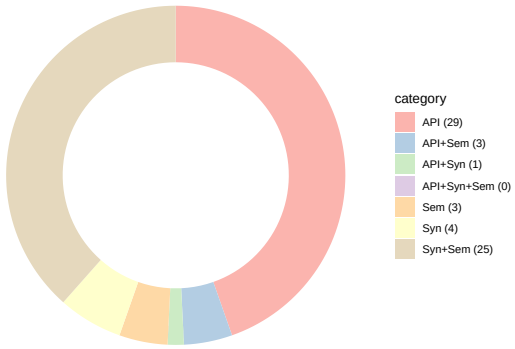
- API only
- Semantic only
- Syntactic only
- API and Semantic
- API and Syntactic
- Semantic and Syntactic
- API and Semantic and Syntactic

Proposal Categories: Explainer

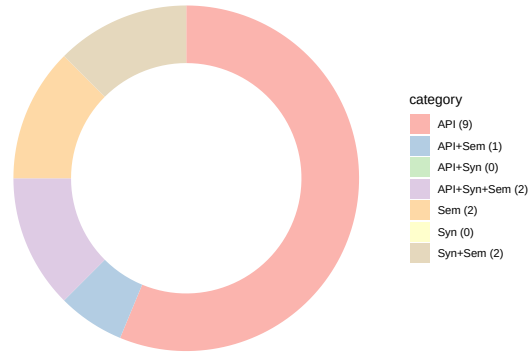
	Category	Description
Primary categories	***API Proposal***	**modifications to the standard library** (built-ins and their observable behavior)
	Syntactic Proposal	**ergonomic grammar enhancements** (syntactic sugar to improve the ergonomics of the language)
	Semantic Proposal	**modifications to the interpretation, evaluation, or observable behaviour of existing or new language constructs,** independent of concrete syntax or standard library APIs
Composite categories	*Syntactic + Semantic*	modifications to the interpretation, evaluation, or observable behaviour of existing or new language constructs, *together with modifications to the concrete syntax*
	Syntactic + API	modifications to the standard library with (ergonomic) grammar enhancements
	Semantic + API	modifications to the interpretation, evaluation, or observable behaviour of existing or new language constructs, together with modifications to the standard library
	Syntactic + Semantic + API	modifications to the interpretation, evaluation, or observable behaviour of existing or new language constructs, together with modifications to the concrete syntax and to the built-ins and/or their observable behaviour

Specific Classifications

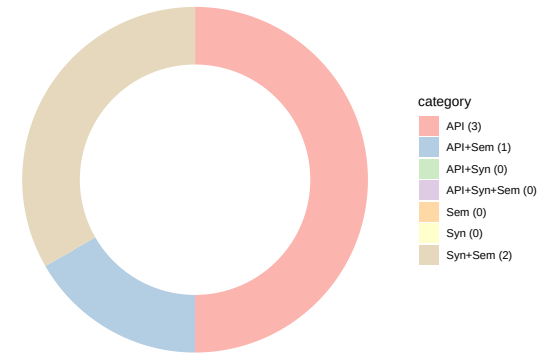
Specific Classification Distribution at Stage 4



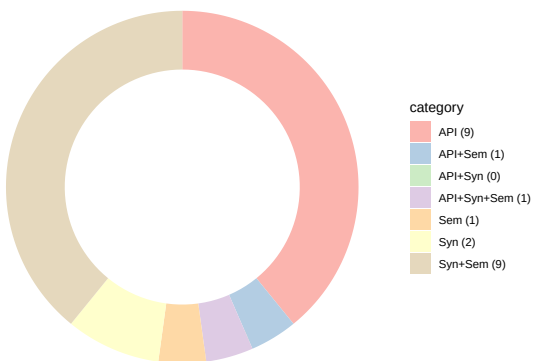
Specific Classification Distribution at Stage 3



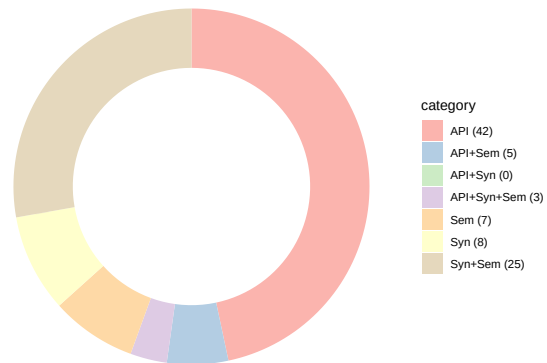
Specific Classification Distribution at Stage 2.7



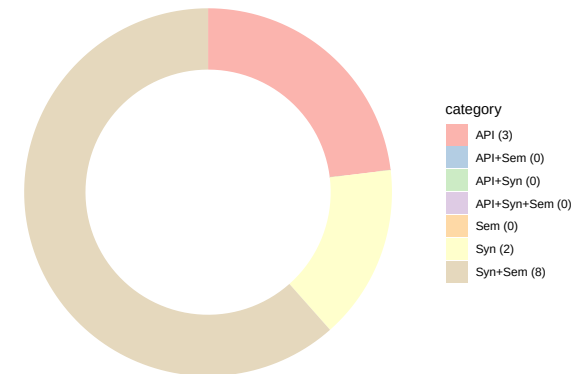
Specific Classification Distribution at Stage 2



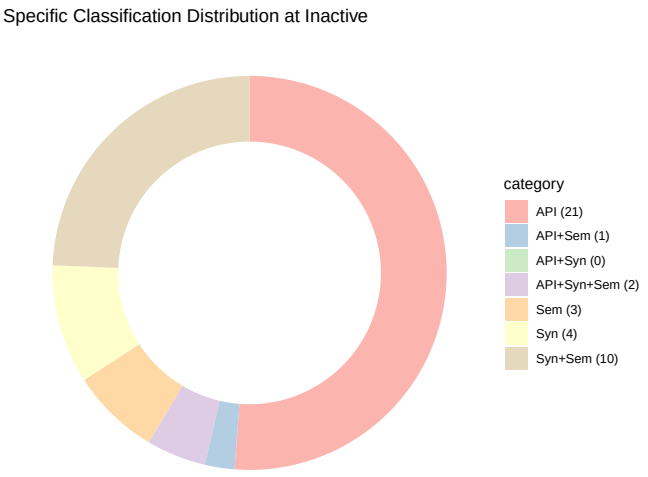
Specific Classification Distribution at Stage 1



Specific Classification Distribution at Stage 0

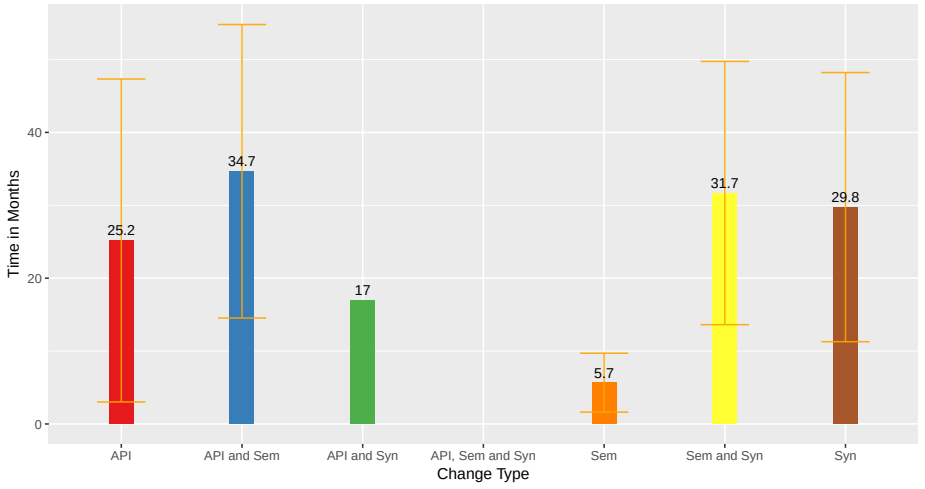


Continuing with Inactive

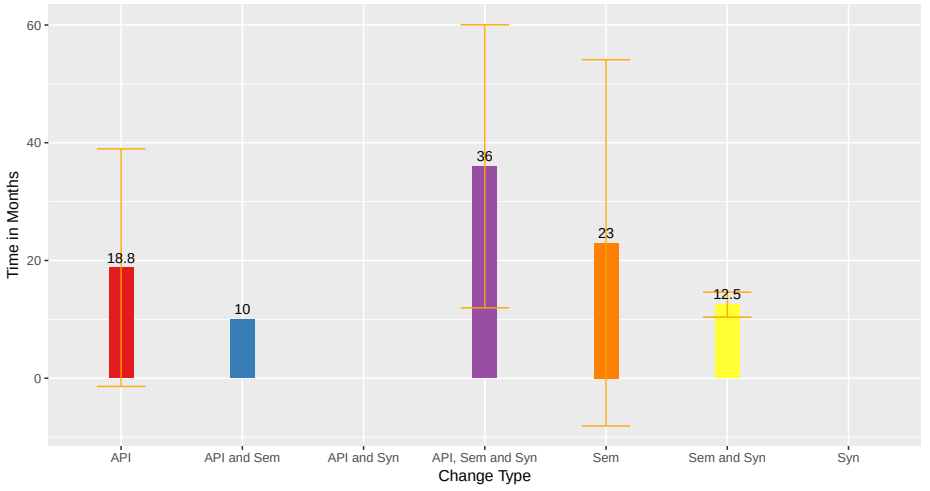


Time From Stage 1

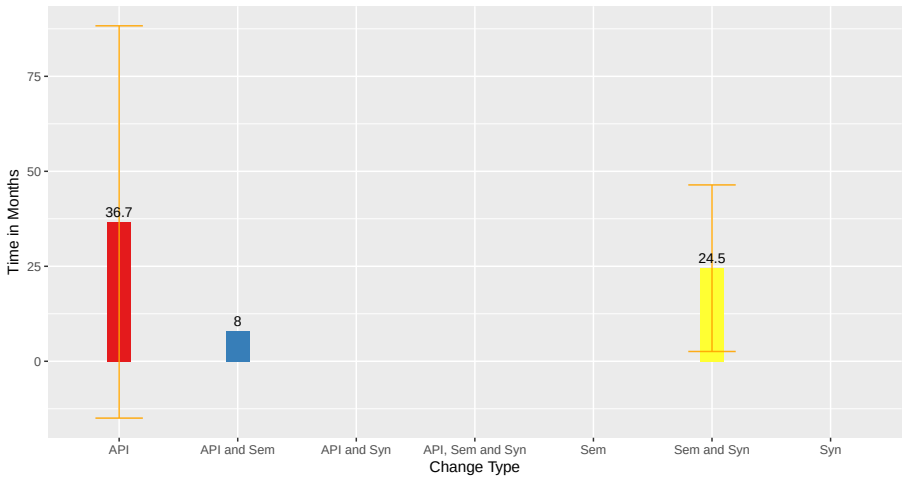
Stage 4: Time from Stage 1 to Stage 4



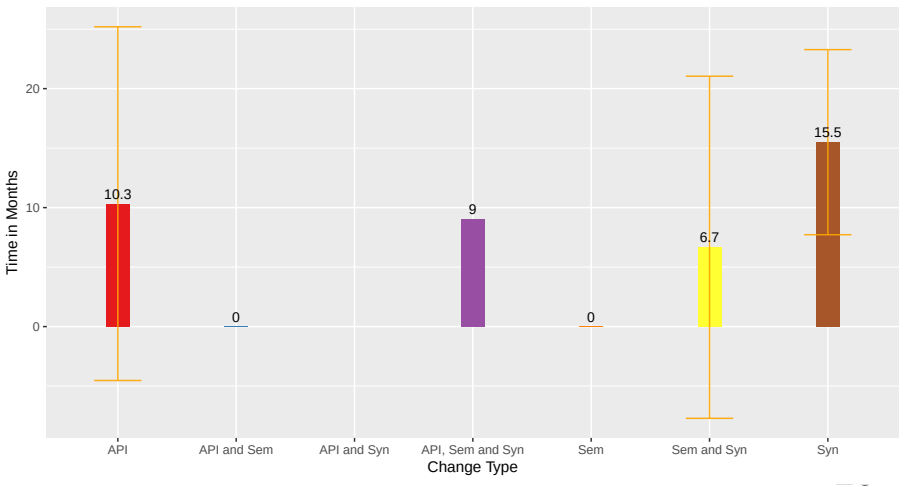
Stage 3: Time from Stage 1 to Stage 3



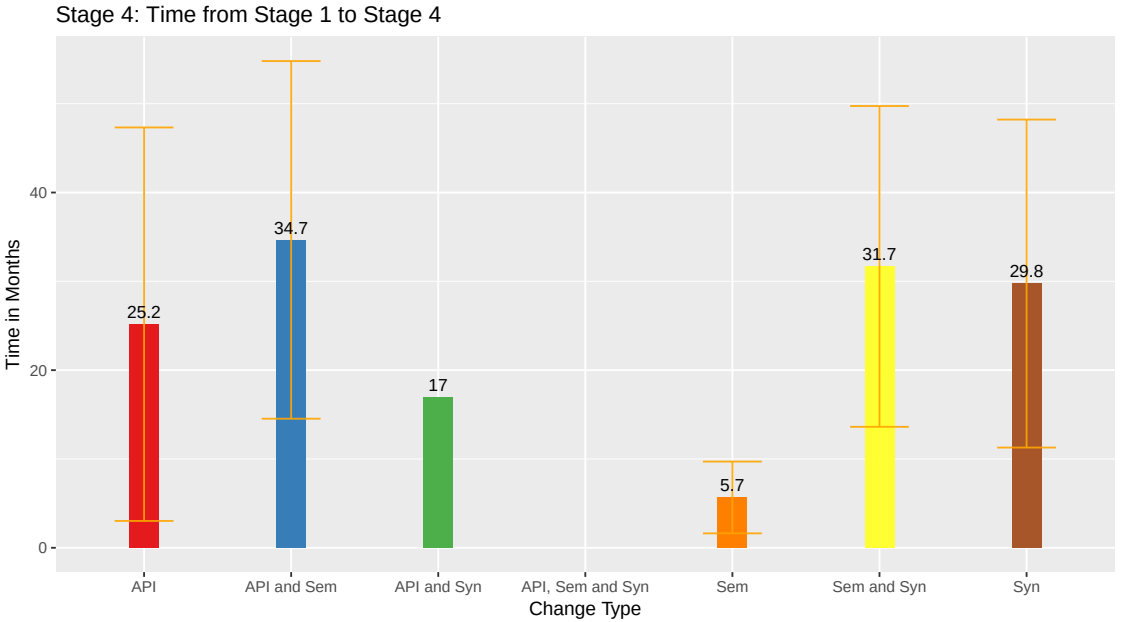
Stage 2.7: Time from Stage 1 to Stage 2.7

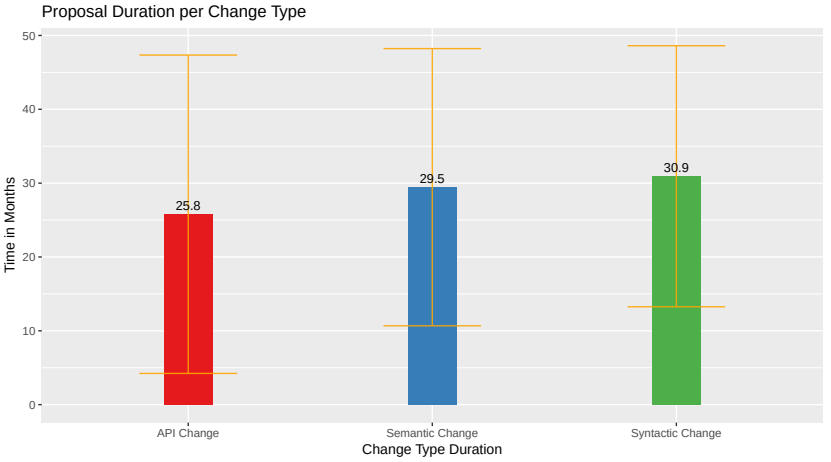


Stage 2: Time from Stage 1 to Stage 2

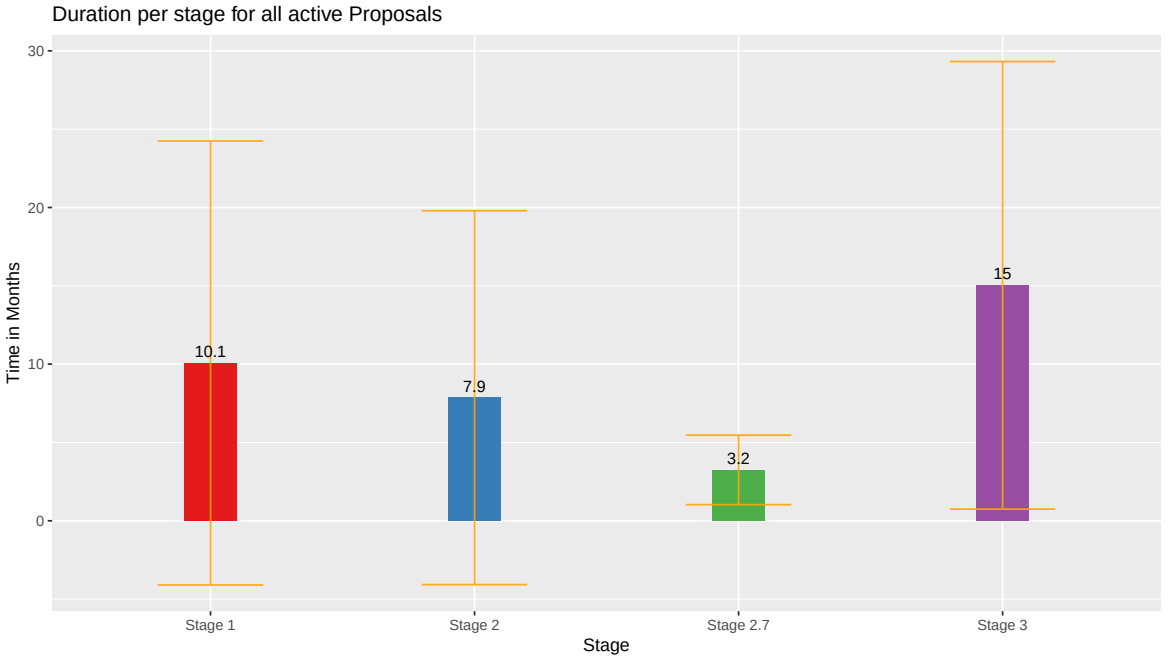


Comparison granular vs overlapping classification





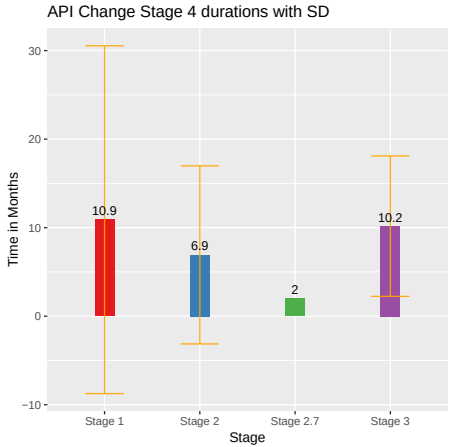
Duration per Stage

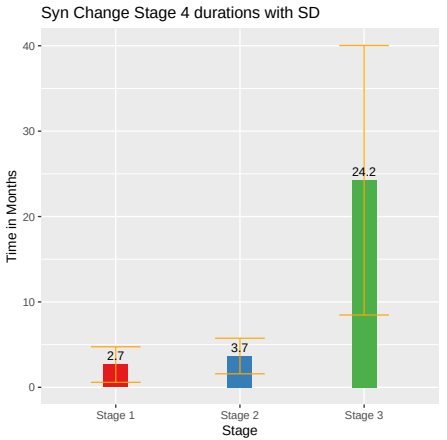


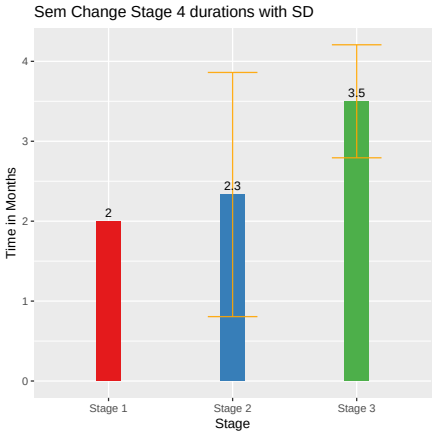
Observations:

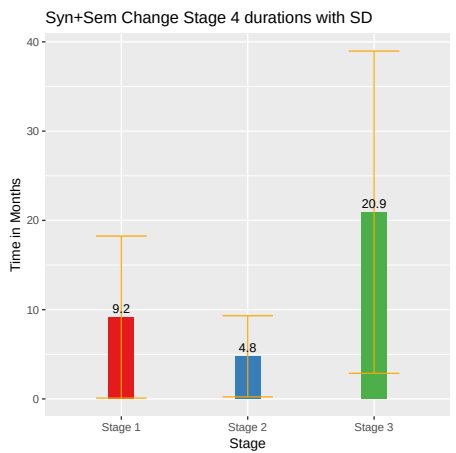
- Length Stage 3 → Stage 1 → Stage 2 → Stage 2.7
- Large SD
- Stage 2.7 is the smallest group

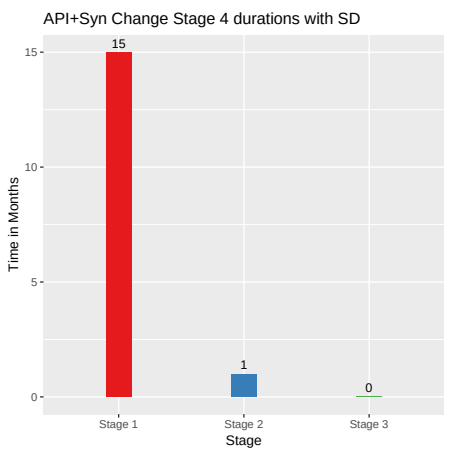
Durations per stage for Stage 4 per classification

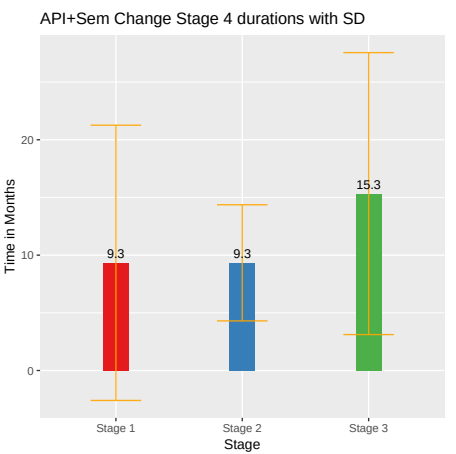




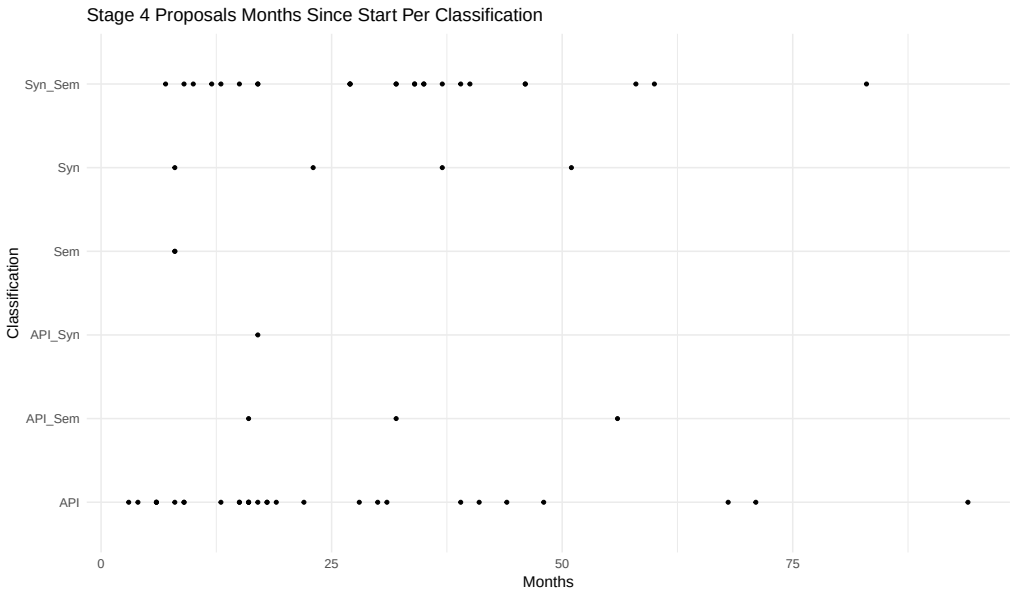


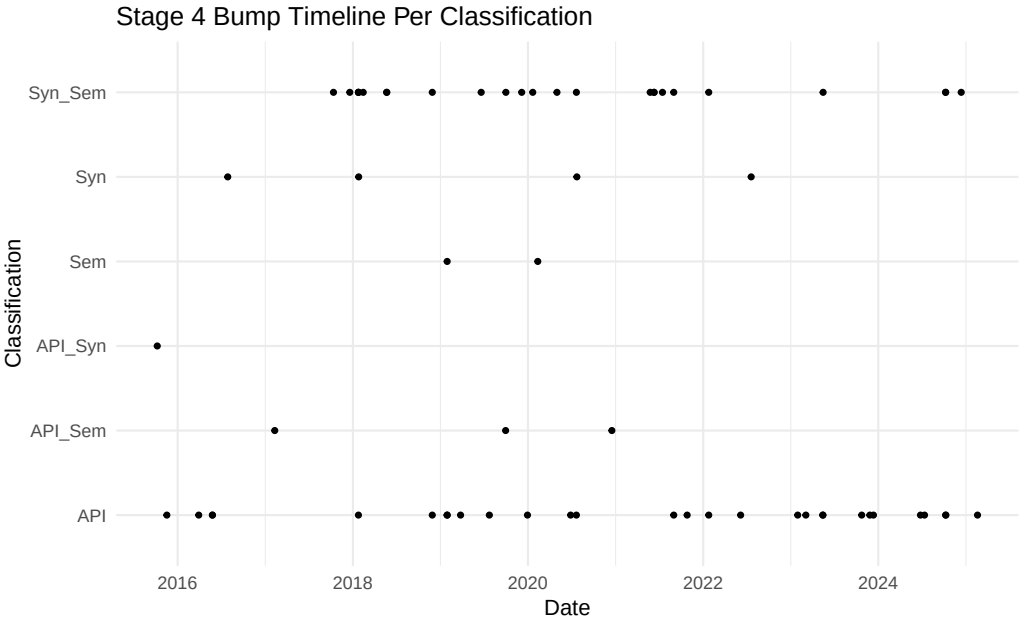






Stage 4 Proposals per Classifications





326 Keywords

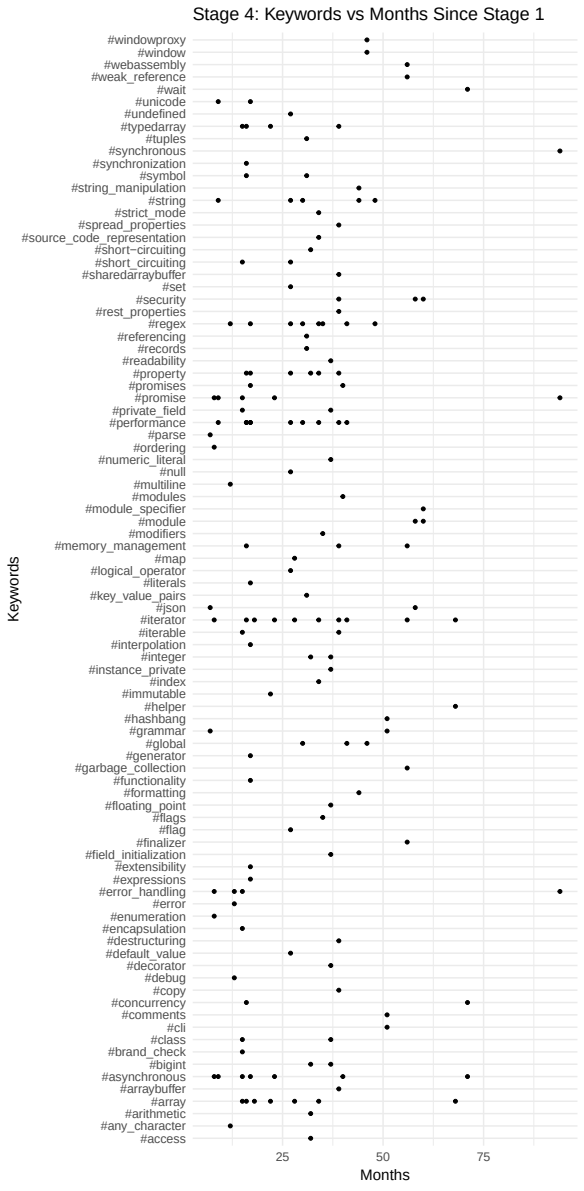
Rank	Keywords	n
1	#performance	32
2	#iterator	26
3	#asynchronous	22
4	#promise	22
5	#module	21
6	#regex	20
7	#array	19
8	#property	19
9	#class	18
10	#security	18
11	#string	17
12	#error_handling	15
13	#memory_management	15
14	#typedarray	12
15	#concurrency	10

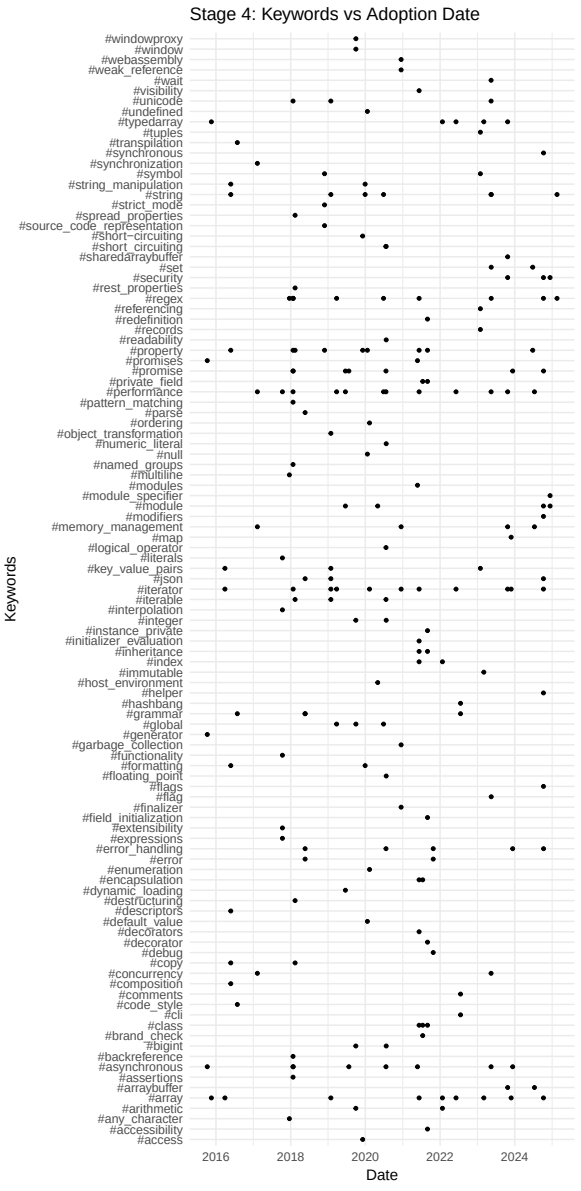
Rank	Keywords	n
16	#arithmetic	9
17	#destructuring	8
18	#map	8
19	#numeric	8
20	#arraybuffer	7
21	#decorator	7
22	#json	7
23	#math	7
24	#unicode	7
25	#bigint	6
26	#generator	6
27	#global	6
28	#iterable	6
29	#key_value_pairs	6
30	#parse	6

Rank	Keywords	n
31	#realm	6
32	#symbol	6
33	#date_time	5
34	#encapsulation	5
35	#grammar	5
36	#metadata	5
37	#operator	5
38	#pattern_matching	5
39	#readability	5
40	#resource_management	5
41	#set	5
42	#string_manipulation	5
43	#synchronous	5
44	#wait	5
45	#accessor	4

Keywords Continued

- Too many keywords
- Reduce to 20



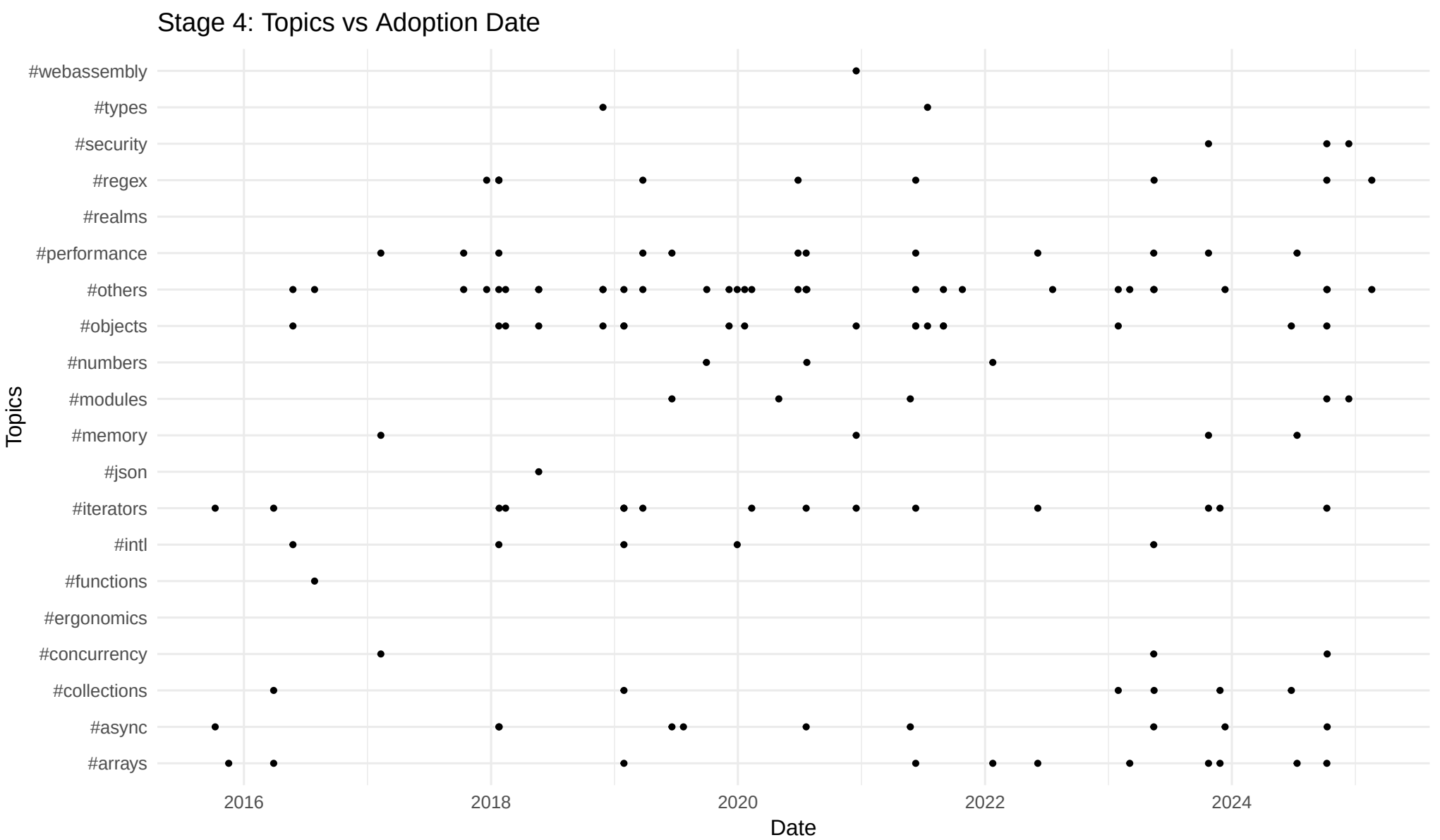


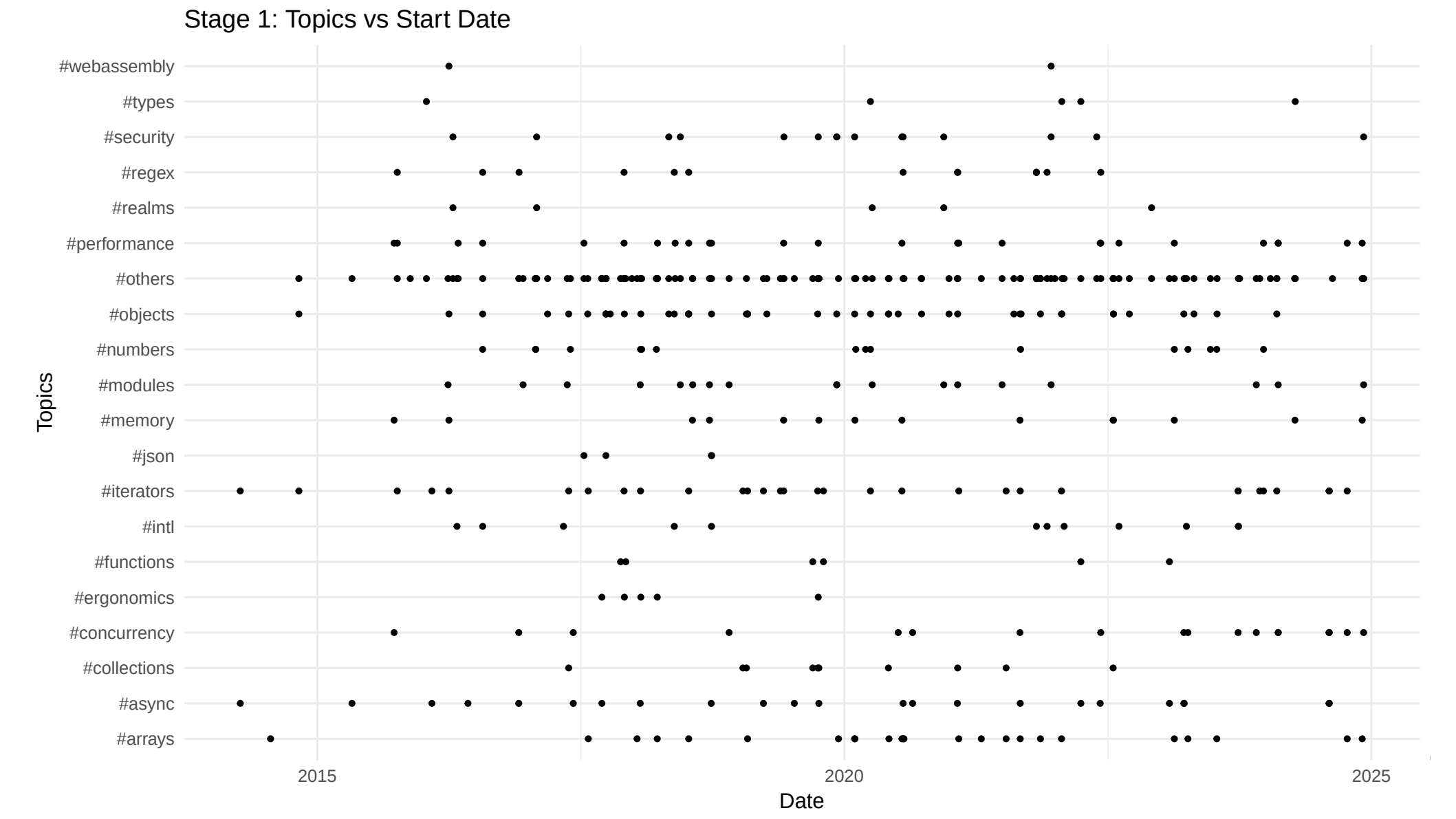
Topics

- Topics are broader than keywords
- Keywords are more individual

- Can be refined but this is a starting point

Rank	Topics	Count
1	#others	281
2	#objects	131
3	#async	51
4	#arrays	47
5	#iterators	45
6	#modules	37
7	#numbers	36
8	#performance	32
9	#concurrency	31
10	#collections	25
11	#regex	25
12	#security	23
13	#memory	22
14	#intl	21
15	#functions	12
16	#types	11
17	#realms	9
18	#ergonomics	8
19	#json	6
20	#webassembly	2


Stage 4: Topics vs Adoption Date
Topics
#webassembly
#types
#security
#regex
#realms
#performance
#others
#objects
#numbers
#modules
#memory
#json
#iterators
#intl
#functions
#ergonomics
#concurrency
#collections
#async
#arrays
2016
2018
2020
2022
2024
Date


Stage 1: Topics vs Start Date
#webassembly
#types
#security
#regex
#realms
#performance
#others
#objects
#numbers
#modules
#memory
#json
#iterators
#intl
#functions
#ergonomics
#concurrency
#collections
#async
#arrays
Topics
2015
2020
2025
Date