

Multi-column Float Proposal

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1 Motivation

Typst is a very powerful typesetting engine, however, it is still incomplete and limited in certain scenarios. Below are some of the scenarios that existing versions of typst struggle with, as well as other scenarios that typst should support in the future.

1.1 Global column-sizing

With the existing layout engine design, element sizing depends on its local scope. If the column feature is activated for the entire document, then all subsequent elements sizing will reflect that, resulting in awkward rendering of some of the elements (e.g. tables). In addition, if a figure does not fit within the remaining space in a page/column it will move to the next page leaving a content gap behind it.

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Col- umn 1	Col- umn 2	Multi- umn 3	Multi- umn 4	Multi- umn 5	Col- umn 6	Multi- umn 7	Col- umn 8
Row 1	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	×
Row 2	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	×
Multi- Row 3	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	✓
Multi- Row 4	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	×
Row 5	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	✓

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1.2 Page-width figures

Just allowing elements to escape the global scope context is not enough as it still doesn't solve the gap issue.

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Column 1	Column 2	Multi Column 3	Multi Column 4	Multi Column 5	Column 6	Multi Column 7	Column 8
Row 1	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 2	●●●	●●●	●●●	●●●	●●●	●●●	×
Multi Row 3	●●●	●●●	●●●	●●●	●●●	●●●	✓
Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

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1.3 Remove content gaps

I expect that being able to remove content gaps will be the primary usecase for the majority of typst users for both column-width and page-width figures.

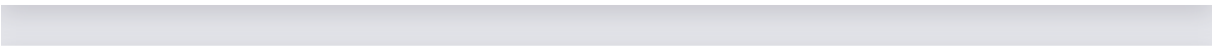
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Row 1	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	×
Row 2	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	×
Multi- Row 3	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	✓
Multi- Row 4	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	×
Row 5	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	✓

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ab Epicuro sapiens semper beatus inducitur: finitas habet cupiditates, negligit mortem, de diis immortalibus sine ullo metu vera sentit, non dubitat, si ita res se habeat. Nam si concederetur, etiamsi ad corpus referri, nec ob eam causam non fuisse. – Torquem detraxit hosti. – Et quidem se textit, ne interiret. – At magnum periculum adiit. – In oculis quidem exercitus. – Quid ex eo est consecutus? – Laudem et caritatem, quae sunt vitae sine metu degendae praesidia firmissima. – Filium morte multavit. – Si sine causa, nollem me ab eo et gravissimas res consilio ipsius et ratione administrari neque maiorem voluptatem ex infinito tempore aetatis percipi posse, quam ex hoc facillime perspici potest: Constituamus aliquem magnis, multis, perpetuis fruentem et animo.



Column 1	Column 2	Multi Column 3	Multi Column 4	Multi Column 5	Column 6	Multi Column 7	Column 8
Row 1	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 2	●●●	●●●	●●●	●●●	●●●	●●●	×
Multi Row 3	●●●	●●●	●●●	●●●	●●●	●●●	✓
Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

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It is important here that if a figure does not fit into the current page/column because other floating figures are claiming the space that we continue adding other content (unless explicitly asked not to) to avoid weird rendition like the one below:



and great clouds of smoke and ash into the air.

Encounters

Shale's wide forests, flat plains, and long, deep, tunnels all bring equal chances of someone, or something, colliding with anyone wandering the land.



Encounter in Shale							
Rolls	Forest -1, 0	Forest, Plains 1, 2	Forest, Plains, Underground 3, 4	Plains, Underground, Deep 5, 6	Underground, Deep 7, 8	Deep 9, 10	Deep 11, 12
8	☞ Mouthligger	Sulphur Winds	Earthquake	Ground cracks: everyone falls!	Earthquake	Gas Leak	Earth cracks, new passage opens...
7	☞ Basilisk	Heatwave	High Humidity	Flood	☞ ID6 + 3 Gnomes	☞ Ooze	☞ ID6 + 2 Goblins
6	☞ Chincrowler	☞ ID6 + 2 Night Guards Scouts	☞ Noble Caravans, ID6 + 2 Night Guards	☞ ID6 Wandering Elves	☞ Fungal Gardens	☞ ID6 - 4 Bandits	☞ Umber Hulk
5	☞ ID6 Night Guards	☞ Sword Guild Nomads selling armour	☞ ID6 + 4 Wolves	☞ ID6 + 6 Bandits	☞ ID6 + 6 Bandits	Crumbling caverns	☞ ZD6 + 8 Hobgoblins
4	☞ ID6 Griffins	Storm	☞ ZD6 Paper Guild Nomads selling books	☞ Bear	☞ Ooze	☞ Umber Hulk	Mana Lake
3	☞ Woodspy	☞ ID6 + 4 Night Guards	☞ ID6 + 2 Night Guard Scouts	☞ ZD6 Paper Guild Nomads	☞ ID6 + 2 Brigands	☞ Watcher	☞ ID6 + 6 Hobgoblins
2	☞ Mouthligger	☞ ID6 + 4 Paper Guild Nomads	☞ ID6 + 3 Brigands	☞ ID6 + 7 Bandits	☞ Mouthligger	☞ Umber Hulk	☞ ID6 + 6 Hobgoblins
1	☞ ID6 + 3 Brigands	☞ ID6 + 4 Wolves	☞ ID6 + 3 Sword Guild Nomads	☞ ID6 + 3 Bandits	☞ Ooze	☞ Ooze	☞ ID6 + 8 Goblins
0	☞ ID6 + 3 Hibernating Chincrowler	Snowfall	☞ ID6 + 6 Bandits	☞ ID6 + 3 Gnomes	☞ Woodspy	☞ Sword Guild Nomads selling polearms	☞ Umber Hulk

General Tempo Chart	
Roll	Result
6	Encounter, and reroll!
5	Encounter.
4	Encounter.
3	1 day peace.
2	3 days peace.
1	3 days peace.

Journeys To to the forest add -2 to the left-hand die, the underground adds +2, and venturing into the Deep Underground adds +4.

Underground Living
The tunnels winding their way around the deeps can provide a relatively safe passage from place to place, though one must know which road to take. This maze of underground forks connects gnomish warrens and dwarvish fortresses.

The dwarves extensively study which tunnels fill with magma, and eagerly await dormant tunnels where they can build new homes where the magma has subsided. Humans in the area often herd their animals into barns or their own houses, and then put themselves into small underground bunkers to await the passing of the storm.

Dwarvish citadels here are massive, and do not suffer from the storms above. Even when flooding occurs during storms, the drainage is adequate, and water never dampens dwarven shoes.

Gnomish warrens fare less well, as gnomes typically try to plan far in advance, but only act when something is happening.

Oozes – they keystone species of all underground areas – inhabit areas by water, and use their membranous bodies to extract nutrients from above. Every so often a corpse will fall into some underground river, providing a feast, and allowing the ooze to experience a growth spurt.

Most mushrooms can grow around oozes, feeding from them, without suffering from their acidic touch. Once an area has produced too many mushrooms for an ooze to survive comfortably, it goes searching for a different water source.

The Shattered Dungeon Wing

Rex Wyatt's castle sits high on a mountain's side, viewing the sea. In the far distance, on a clear day, it is possible to see the segment of the Shattered Castle in the Pebbles. The castle's underground sections provides the main point of trade to various dwarvish realms, bringing food and wood. This is the main stronghold Rex Wyatt has over the dwarves, which then forces them to pay taxes on all goods sold.

1.4 Remove content gaps and enable positional placement

However, in some cases such academic journal explicit placement of elements (e.g. figure) might be required. One such example is IEEE, that requires full-width figures to be placed at the top of the page. Another user pointed out that it is also convention, that if both an image and a table appear in the same page that the table must be rendered at the top while the image at the bottom.

Column 1	Column 2	Multi Column 3	Multi Column 4	Multi Column 5	Column 6	Multi Column 7	Column 8
Row 1	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 2	●●●	●●●	●●●	●●●	●●●	●●●	×
Multi Row 3	●●●	●●●	●●●	●●●	●●●	●●●	✓
Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

Column 1	Column 2	Multi Column 3	Multi Column 4	Multi Column 5	Column 6	Multi Column 7	Column 8
Row 1	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 2	●●●	●●●	●●●	●●●	●●●	●●●	×
Multi Row 3	●●●	●●●	●●●	●●●	●●●	●●●	✓
Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

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Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

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Column 1	Column 2	Multi Column 3	Multi Column 4	Multi Column 5	Column 6	Multi Column 7	Column 8
Row 1	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 2	●●●	●●●	●●●	●●●	●●●	●●●	×
Multi Row 3	●●●	●●●	●●●	●●●	●●●	●●●	✓
Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

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aliquid esse minimum, quod profecto numquam putavisset, si a Polyaeo, familiari suo, geometrica discere maluisset quam illum etiam ipsum dedocere. Sol Democrito magnus videtur, quippe homini erudito in geometriaque perfecto, huic pedalis fortasse; tantum enim esse omnino in nostris poetis aut inertissimae segnitiae est aut fastidii delicatissimi. Mihi quidem videtur, inermis ac nudus est. Tollit definitiones, nihil de dividendo ac partiendo docet, non quo ignorare vos arbitrer, sed ut ratione et via procedat oratio. Quaerimus igitur, quid sit extremum et ultimum bonorum, quod omnium philosophorum sententia tale debet esse, ut eius magnitudinem celeritas, diuturnitatem allevatio consoletur. Ad ea cum accedit, ut neque divinum numen horreat nec praeteritas voluptates effluere patiatur earumque assidua recordatione laetetur, quid est, quod huc possit.

Column 1	Column 2	Multi Column 3	Multi Column 4	Multi Column 5	Column 6	Multi Column 7	Column 8
Row 1	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 2	●●●	●●●	●●●	●●●	●●●	●●●	×
Multi Row 3	●●●	●●●	●●●	●●●	●●●	●●●	✓
Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

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1.5 Remove content gaps and enable contextual placement

“In a lot of cases, it’s far more important to say ‘place this element somewhere before the next subsection’ than making a statement about the position. Here’s a table that could have been better placed by floating anywhere else after the `\subsection{Encounters}`.” - Andonome (Github comment)

use the road to warmer climates, such as Quennome or Liberty.

Liberty

A generation ago, gnolls ruled Dogland, with only sparse human villages dotted around the outer rim. Rex Nolan decided the area would be ‘civilized’, and drafted an army of the Night Guard. Humanity did badly, but the Rex continued pushing everyone he could until settlements had been established.

Since then, the Temple of Véré have rebranded themselves as ‘the Justice Guild’, and ‘put the gnolls to work’. This alternative guild-branch call themselves ‘the Gnoll Guild’, and use forced Gnoll labour to build new settlements. Anyone joining either the Gnoll Guild or serving in the local Night Guard received a home in the area. To emphasise their newfound freedom, they named the region ‘Liberty’.

The region has provided excellent logging, and the nearby forests have been tamed fairly quickly. However, the danger lurks in the foliage of the deep forest. As a result, all human settlements within the region are surrounded by towering wooden walls and manned with archers.

Encounters

Roll	Result
6	Encounter, and reroll!
5	Encounter.
4	Encounter.
3	Encounter.
2	1 days peace.
1	3 days peace.

Journeys to the Edge add +2 to the left-hand die, while excursions into the forest add +3.

Liberty’s warm, humid, climate breeds constant danger, but also brings a lot of cheer on the road as plenty of traders travel across the roads constantly.

The Night Guard and Justice Guild patrol the areas between villages constantly, as Liberty receives a lot of financial aid from Rex Wyatt to ensure everyone remains safe, and expands. Of course, the Night Guards prefer patrolling the inner areas more than the deep forest, so once travellers take a few steps beyond a known path, and approach the Edge, they can expect to see a lot more danger, including gnolls who have a serious problem with any humans on their land.

Humanity’s constant logging has upset the local ecosystem, and anyone in or around human settlements now experiences sudden floods during the warm and stormy seasons.

Heatwaves also present a major problem for most humans. Of course, Liberty has always had hot weather, but it also had enough trees to bind the soil together. The human habit of felling trees to create large, empty, areas, has resulted in mudslides, rivers changing course

1.6 Vertical-only

Just allowing for text to wrap around figure without any restriction can result in unwanted artifacts. One such example can be an image that doesn’t cover the entire width of the page and thus allows for very little text (1-2 words) to wrap on its sides resulting in a very ugly rendition. Giving an option to disable horizontal wrapping would alleviate the issue.

sint et molestiae non recusandae. Itaque earum rerum defuturum, quas natura non depravata desiderat. Et quem ad me accedis, saluto: 'chaere,' inquam, 'Tite!' lictores, turma omnis chorusque: 'chaere, Tite!' hinc hostis mi Albucius, hinc inimicus. Sed iure Mucius. Ego autem mirari satis.

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Row 2	●●●	●●●	●●●	●●●	●●●	●●●	×
Multi Row 3	●●●	●●●	●●●	●●●	●●●	●●●	✓
Multi Row 4	●●●	●●●	●●●	●●●	●●●	●●●	×
Row 5	●●●	●●●	●●●	●●●	●●●	●●●	✓

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1.7 Horizontal-only wrapping

In other cases, we might want to enable only content wrapping only in the horizontal direction (e.g. books and magazines).

SORCERER

Golden eyes flashing, a human stretches out her hand and unleashes the dragonfire that burns in her veins. As an inferno rages around her foes, leathery wings spread from her back and she takes to the air.

Long hair whipped by a conjured wind, a half-elf spreads his arms wide and throws his head back. Lifting him momentarily off the ground, a wave of magic surges up in him, through him, and out from him in a mighty blast of lightning.

Crouching behind a stalagmite, a halfling points a finger at a charging troglodyte. A blast of fire springs from her finger to strike the creature. She ducks back behind the rock formation with a grin, unaware that her wild magic has turned her skin bright blue.

Sorcerers carry a magical birthright conferred upon them by an exotic bloodline, some otherworldly influence, or exposure to unknown cosmic forces. One can't study sorcery as one learns a language, any more than one can learn to live a legendary life. No one chooses sorcery; the power chooses the sorcerer.

RAW MAGIC

Magic is a part of every sorcerer, suffusing body, mind, and spirit with a latent power that waits to be tapped. Some sorcerers wield magic that springs from an ancient bloodline infused with the magic of dragons. Others carry a raw, uncontrolled magic within them, a chaotic storm that manifests in unexpected ways.

The appearance of sorcerous powers is wildly unpredictable. Some draconic bloodlines produce exactly one sorcerer in every generation, but in other lines of descent every individual is a sorcerer. Most of the time, the talents of sorcery appear as apparent flukes. Some sorcerers can't name the origin of their power, while others trace it to strange events in their own lives. The touch of a demon, the blessing of a dryad at a baby's birth, or a taste of the water from a mysterious spring might spark the gift of sorcery. So too might the gift of a deity of magic, exposure to the elemental forces of the Inner Planes or the maddening chaos of Limbo, or a glimpse into the inner workings of reality.

Sorcerers have no use for the spellbooks and ancient tomes of magic lore that wizards rely on, nor do they rely on a patron to grant their spells as warlocks do. By learning to harness and channel their own inborn magic, they can discover new and staggering ways to unleash that power.

UNEXPLAINED POWERS

Sorcerers are rare in the world, and it's unusual to find a sorcerer who is not involved in the adventuring life in some way. People with magical power seething in their veins soon discover that the power doesn't like to stay quiet. A sorcerer's magic wants to be wielded, and it has a tendency to spill out in unpredictable ways if it isn't called on.

1.8 Circular wrapping

And in others, wrapping around a figure might be the desired user intention.

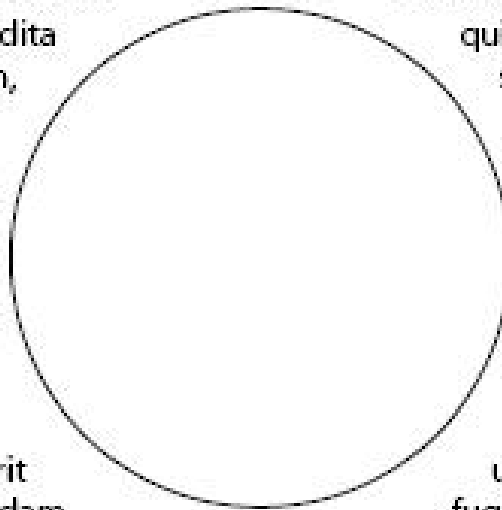


Circular exclusion-shape within text

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labo. Et, temquam,
nia prem aperum,
evelese quassum
ex estotatem
excescipsus sunt
rehent enia con-
dae mos aute
et et quamus vol-
vendigenis nam,
uae nosae laut parit
voluptatae si audam
bus porempo rehende nis



quiae simusciis repel-
suntur alique cum
il endae venimus
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perro et voluptas
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ut as as expe que
fuga. Nequis endaeri-
doluptis ma quam, con par-

citatus dolorpore veliqui idesHabem, quam consi impritrarte, consimo
meditifex sitanum audet int, Catis omnis, quam nunte quam tam maxi-
mus ad crenequi publint ienatili, C. Me patifecris, nihilin abis cae patio-
rtui cum hore, con peri publicae neque publica re cres sulturo tum quis

1.9 Figure-only page

Finally, in other cases we might only want to break the column rules and render with the full width of the page for a series of images (e.g. figure page) without allowing for any next in that page. In that case the user should be able to disable wrapping altogether.

Encounters in Whiteplains								
	Villages	Villages, Edge	Villages, Edge, Forest	Villages, Edge, Forest	Villages, Edge, Forest	Villages, Edge, Forest	Edge	Forest
Rolls	1	2	3	4	5	6	7	8
8	h Villagers fighting	Hailstorm	Lightning Storm	Earthquake	Hurricane	¶1D6 + 5 Gnolls	Auroch Stampede	Deer
7	Flood	§ Woodspy	Thick Mist	Rain	Mist	Mouthdigger	♣ Boar	♣ Bear
6	h 1D6 Night Guards	♣ 2D6 Night Guards	Rain	Heavy Hall	§ Woodspy	♣ 1D6 + 2 Snow Elves	♣ Auroch stampede	♣ 1D6 Griffins
5	h Prefect caravan (4D6 Night Guards)	h Priest of Qualmè	h 1D6 + 8 Bandits	♣ 1D6 + 4 Wolves	Lightning Storm	¶ 1D6 + 3 Gnolls	♣ Deer Heard	Mana Lake
4	h Villager Funeral	h 1D6 + 4 Bow Sellers	Biting Wind	♣ Bear	♣ Wolves	♣ Snow Elf disguised as human	♣ 3D6 Ghouls	♣ 1D6 Griffins
3	h Villager Wedding	h 4D6 Night Guard trainees	h 1D6 + 4 Brigands	h 2D6 Refugees from Fallen Village	♣ 1D6 Snow Elves riding Griffins	h 1D6 + 4 Brigands	♣ Dryad	Portal to Realm of Shifting Corridors
2	h Vegetable Traders	h 3D6 Pilgrims	Biting Wind	h 1D6 + 8 Bandits	♣ Griffin	h 1D6 + 2 Night Guards	♣ Griffin	¶♣ 1D6 + 2 Gnoll Hunters, 1 Dog each
1	Snow blocks road	♣ Sword Guild Traders	1D6 ¶ Dog Sellers	Snowstorm	h 1D6 + 8 Bandits	♣ 2D6 Crossbow Traders	♣ Boar	♣ Auroch Herd wandering
0	h 1D6 Begging Villagers	Snowstorm (roads closed)	Lakes and Rivers Freeze	Heavy Hall	♣ 1D6 + 6 Wolves	Snowstorm	Mist	♣ Deer



2 Proposed API

There are currently two types of elements supported by typst. `flow-nowrap` elements is the default for all elements and `noflow` element is only supported by the `#place` element. A new `flow-wrap` element called `#wrap` can be useful for solving the gap issues 1.3 presented for both the local and global scope. The proposed API changes will apply to the new `#wrap` element and to the `#place` element. I expect that being able to break to the page scope will be a useful for `#place` as well.

- `#place(scope, alignment, dx, dy, body)`
- `#wrap(scope, [alignment], [dx], [dy], direction, body)`

2.1 Wrap Element Algorithm

Algorithm for `#wrap` elements:

1. Calculate `#wrap` element's dimensions and check if the element can fit to existing page/column (other `#wrap` elements might already populate the page)
2. If it can, place `#wrap` element at correct position in current page/column based on its `alignment` policy. Relayout all other content (except other `#wrap` elements) in current page/column.
3. If not, place `#wrap` element at correct position in the next page/column based on its `alignment` policy. Keep adding content to current page until it is filled. Here there will be two types of data structures, one indicating the current page we perform layout on and another indicating pending pages that will be used for laying out subsequent content once the current page is filled.

2.2 Scope

The first breaking change that is proposed is that we introduce a `scope` option to the `#place` element and scope tracking to the layout engine itself. Being able to track the scope of an element will enable the "full-width figure" 1.2 and partially satisfy the contextual placement 1.5 usecase. Extending the scope to cover other scopes such as margin and footnote allows us to cover two common requests for many users in a single unified API.

Scope Options

- `page`
- `margin`
- `main` - (default)
 - `heading`
 - `paragraph`
 - `footnote`

The scope modifiers listed below will allow for more precise scope control for `#place` and `#wrap` elements. This covers the contextual placement 1.5 usecase.

Scope Modifiers

- `previous`
- `current` - (default)
- `next`

2.3 Alignment Rules

Unlike the `#place` element the `#wrap` element accepts a list of alignments. The alignment list can be useful to capture the user's intent. The first alignment in the list is the user's ideal situation and all the other options are there to handle placement conflicts with other `#wrap` elements. Here is a list of examples of alignments and what they mean:

- `[]`: Stay in place or move to top of next page/column (don't leave gaps)
- `[top]`: Must be the topmost figure/tables/etc.

- [top, top, bottom, bottom]: Must be the topmost or 2nd from top or 1st from bottom or 2nd from bottom

The alignment rules allows to fullfil the “Remove content gaps and enable custom placement” 1.4 usecase.

2.3.1 Wrap Conflict Resolution

In case 2 or more #wrap elements are placed in the same position in a page/column fallback arguments can be used to decide its position:

- Repeated secondary alignment - [alignment1, alignment1]: place it to the next available spot (e.g. if 2 #wrap elements request the top position then place the first #wrap element at the top and the second #wrap below it.)
- Alternate secondary alignment - [alignment1, alignment2]: Place the 2nd #wrap to the position indicated by alignment2. Assuming there are no more conflicts the content is laid out again in the available space. If there is another conflict move to the next page and repeat (alignment1 -> alignment2). For example if the first #wrap request the top position then the second can request in the fallback the bottom.
- Only primary alignment - [alignment]: no fallback value is provided, move to the next page and repeat (alignment)
- No primary alignment - []: no primary alignment value is provided, try to fit #wrap into existing page/column. Otherwise move to the top of next page/column. If there is a conflict move to an empty space below
- Only secondary alignment - [, alignment]: Try to place to current page/column at current position. If it doesn’t fit or there is some other conflict use secondary alignment. If there are more conflicts move to the top of next page and repeat

2.4 Wrap Direction

The wrap direction argument allows to express the final 4 usecases for vertical-only 1.6, horizontal-only 1.7, wrapping around 1.8 and disabling wrapping 1.9.

Wrap Direction Options

- Vertical
- Horizontal
- Around
- None