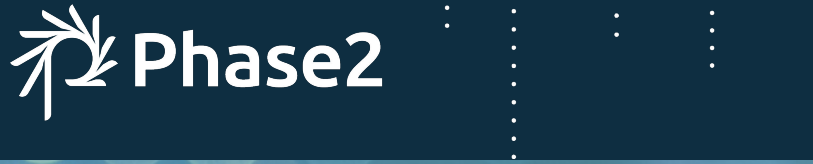
Custom Compound Fields

In Drupal 8

DrupalCon Seattle 2019

April 11, 2019



Introduction

Tobby Hagler

Director of Engineering at Phase2

Past DrupalCon presentations

- Cthulhu Drupal: Coding with Lovecraft
- Building NBA.com on Drupal 8
- Dungeons & Dragons & Drupal
- Drupal is Not Your Website

This afternoon's agenda

What this session will cover...

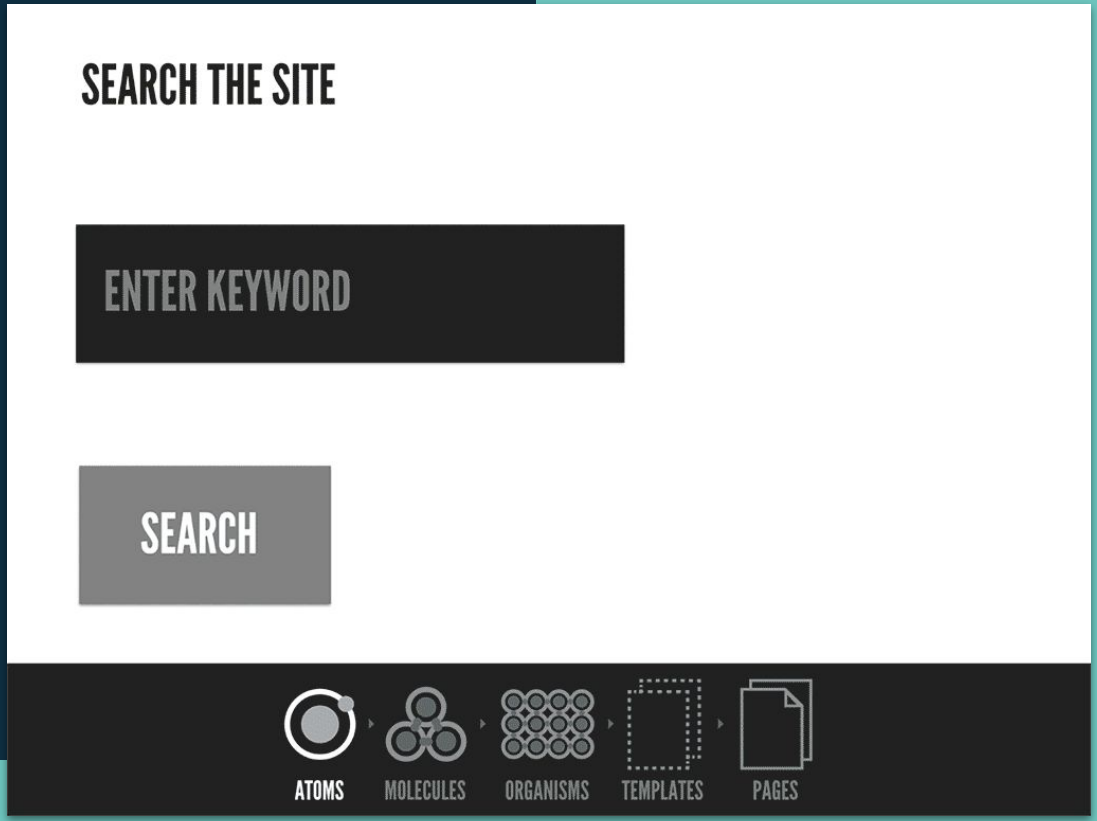
- What is a compound field?
- Examples of compound fields
- Options and tools to build compound fields
  - Site builder oriented
- Drupal 8 Field API and compound field elements
  - Code intensive
  - Pitfalls and tips for writing custom field code
- Brief look at theming compound fields
- Kernel tests for compound fields

What is a Compound Field?

A field composed of multiple elements that represent a single unit of data

Elements of Atomic Design

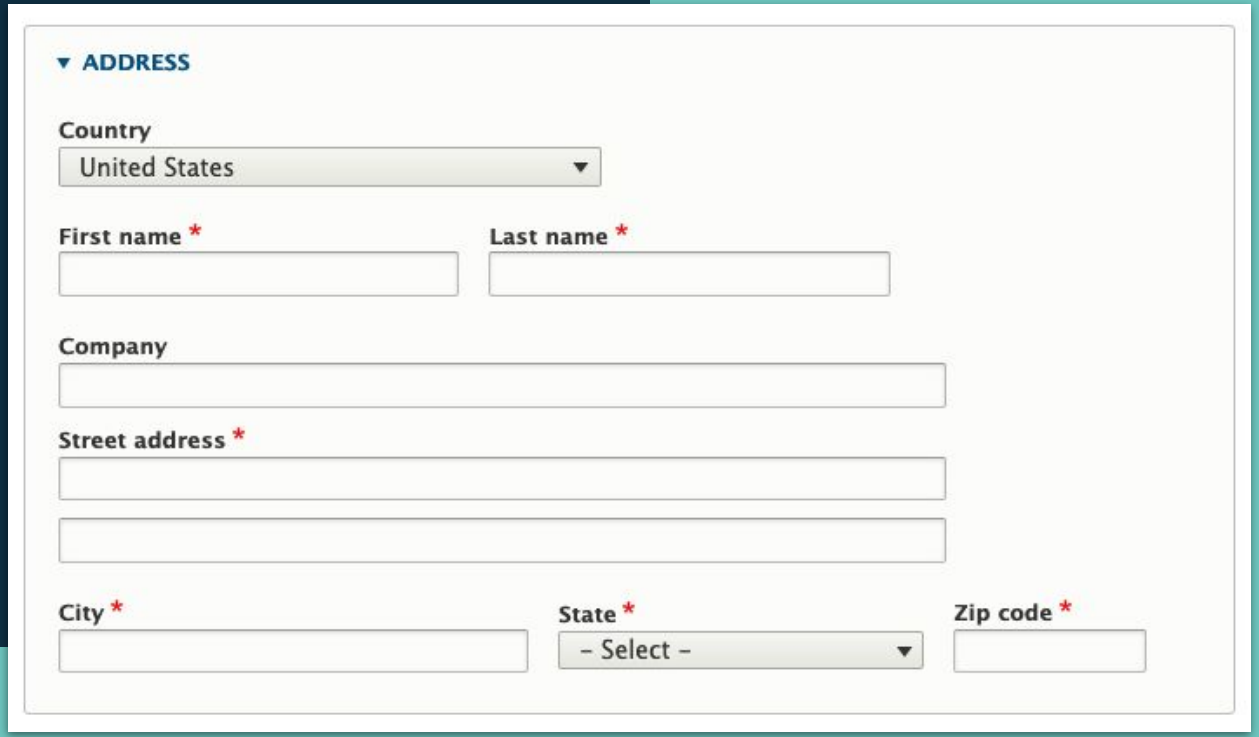
- Atoms
- Molecules
- Organisms
- Templates
- Pages



Gif courtesy Brad Frost ~ bradfrost.com

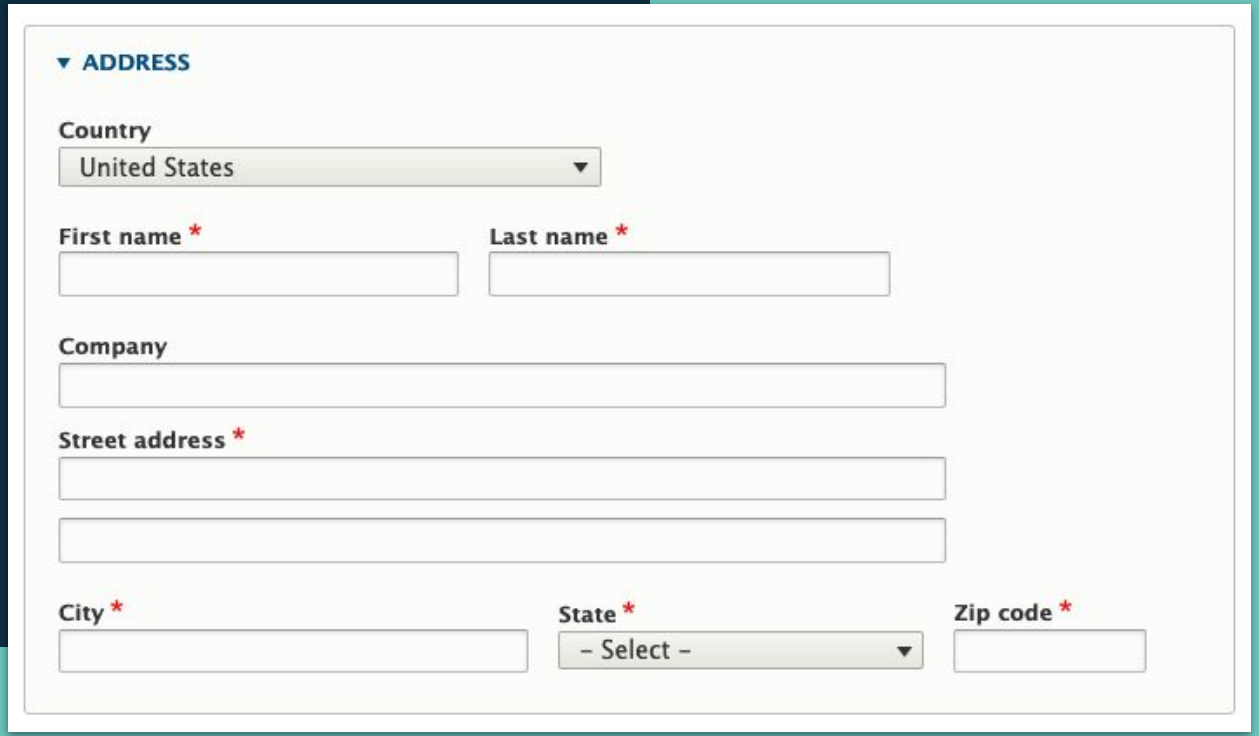
Address field widget
Address module

- Country
- First Name
- Last Name
- Company
- Street Address 1
- Street Address 2
- City
- State
- ZIP code



Address compound field elements

- Country code
- Admin area
- Locality
- Dependent locality
- Postal code
- Sorting code
- Address line 1
- Address line 2
- Organization
- Given name
- Additional name
- Family name



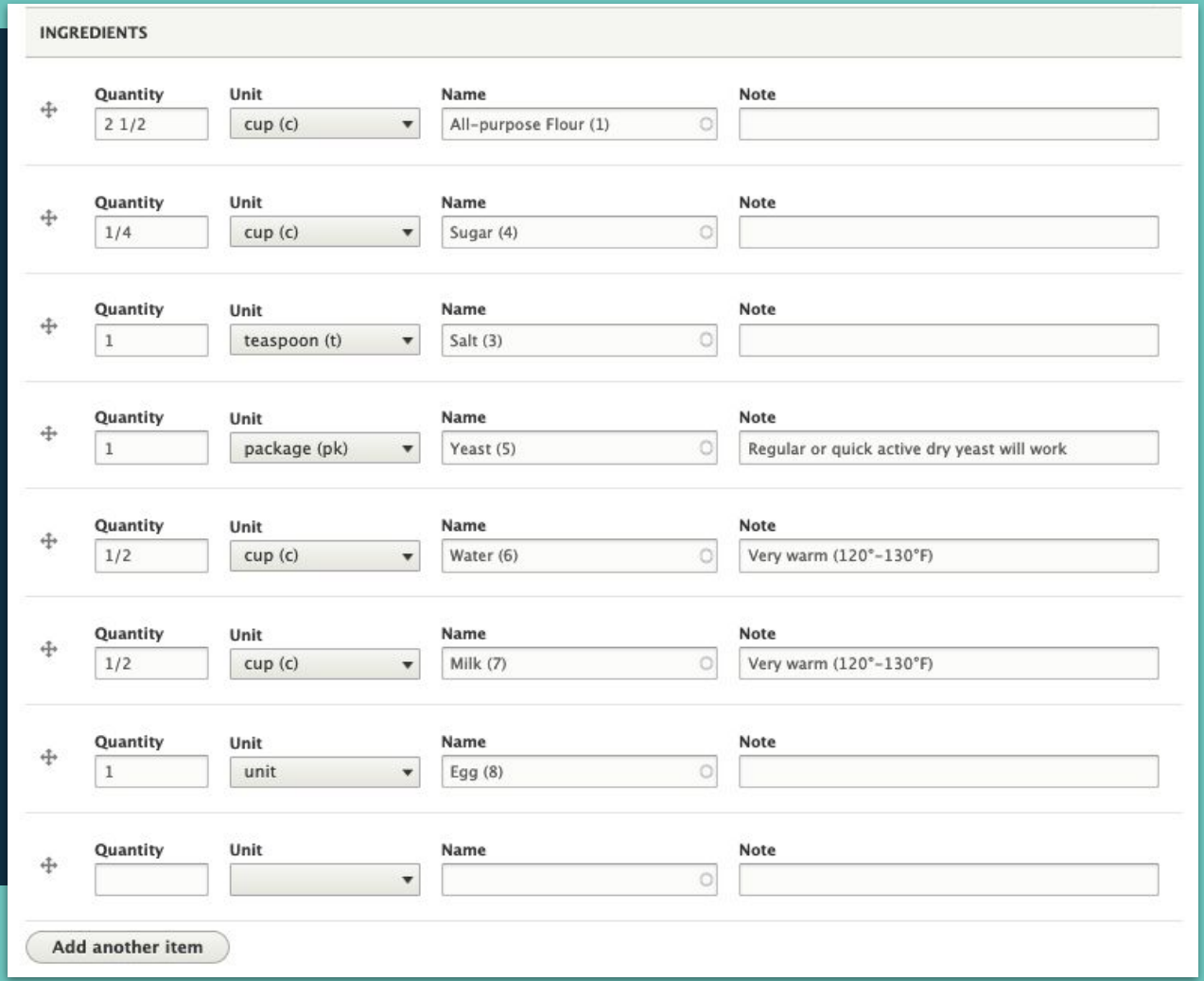
Ingredients list

Recipe content type

Ingredient field

- Field elements
- Infinite cardinality

Recipes module



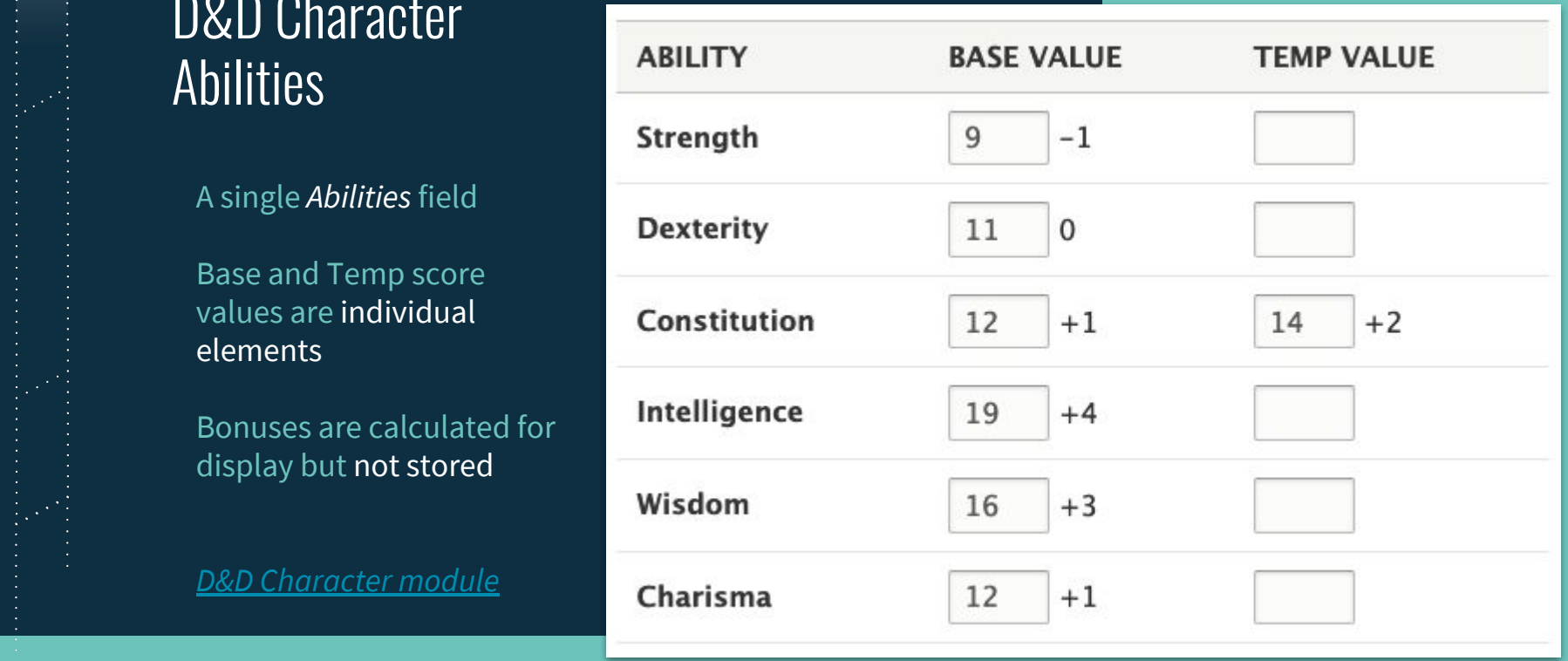
D&D Character Abilities

A single *Abilities* field

Base and Temp score values are individual elements

Bonuses are calculated for display but not stored

D&D Character module



ABILITY	BASE VALUE	TEMP VALUE
Strength	9 −1	
Dexterity	11 0	
Constitution	12 +1	14 +2
Intelligence	19 +4	
Wisdom	16 +3	
Charisma	12 +1	

Creating Compound Fields

Options

Tools, Modules, and APIs

- Paragraphs
- Layout Builder with block types
- Entity Construction Kit + Inline Entity Form, Field Collections, Bricks
- **Custom Field API field**

Examples of compound fields

- Address
- Recipe and ingredients
- Photo carousel on a page
- Medical patient records and prescriptions
- D&D character ability scores

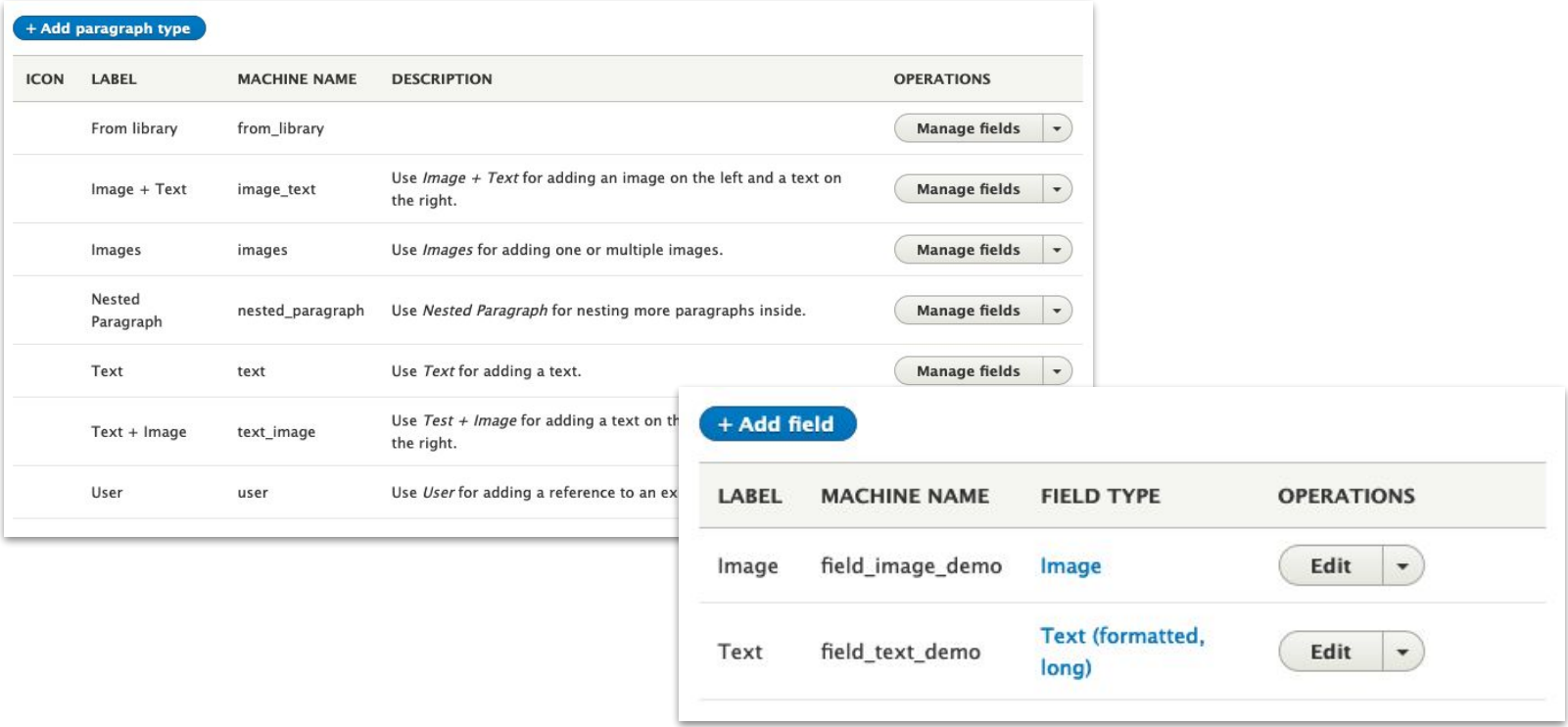
Option 1: Paragraphs

Paragraphs module

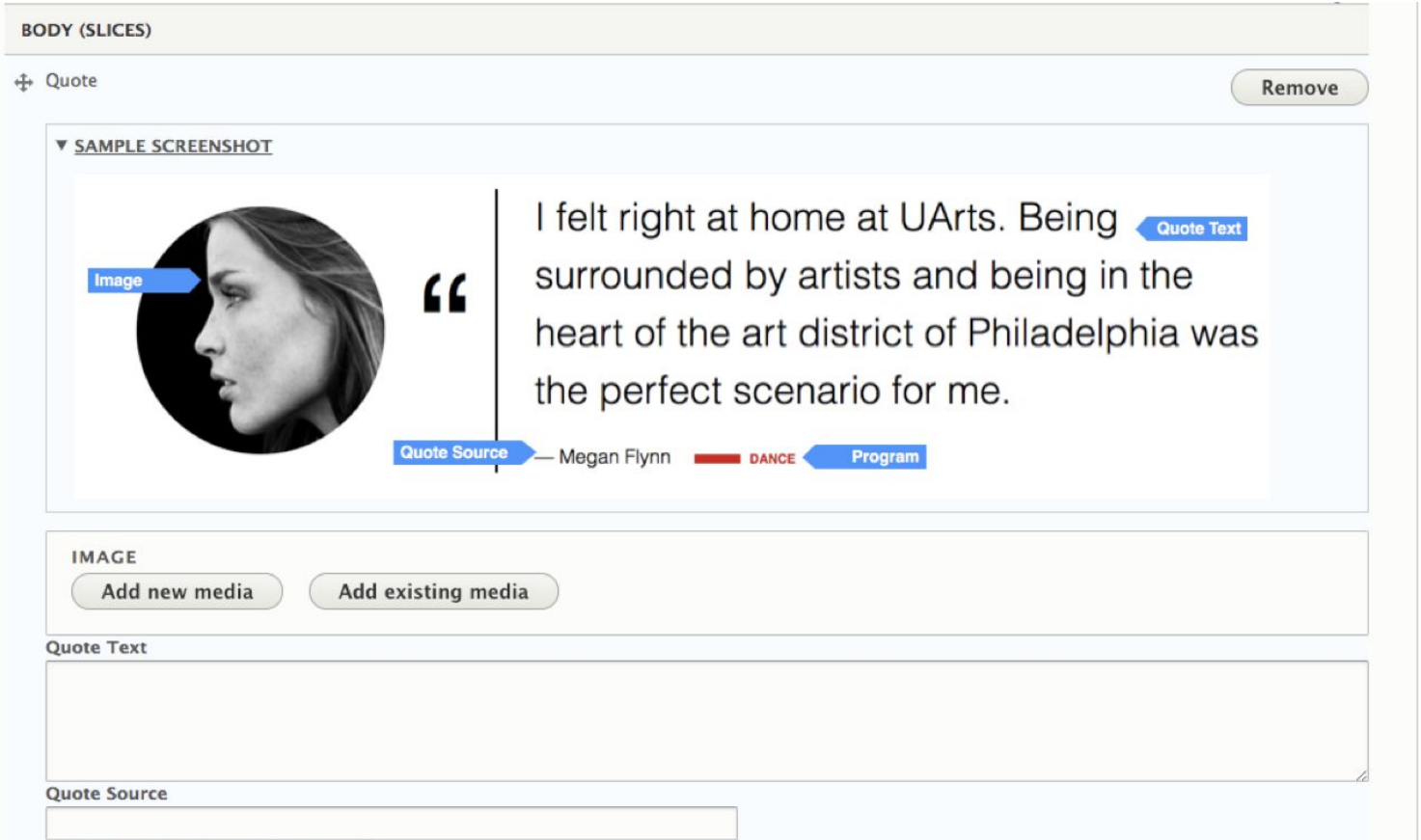
Paragraphs allow for a compound field that is made up of different Drupal fields. Anything that is already a field in Drupal can be added to a Paragraph, including another Paragraph field.

Can be thought of like a “content type” of fields; different Paragraph bundles (“types”) that consist of fields.

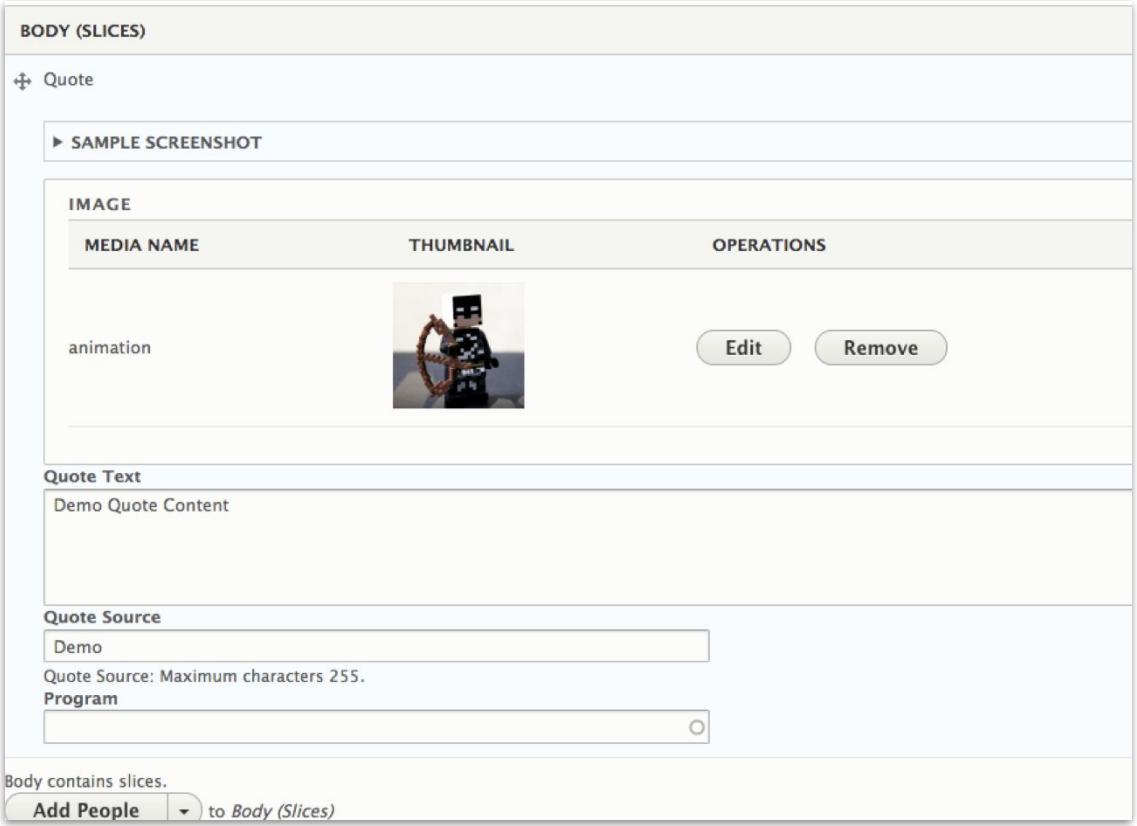
Example Paragraph types and fields



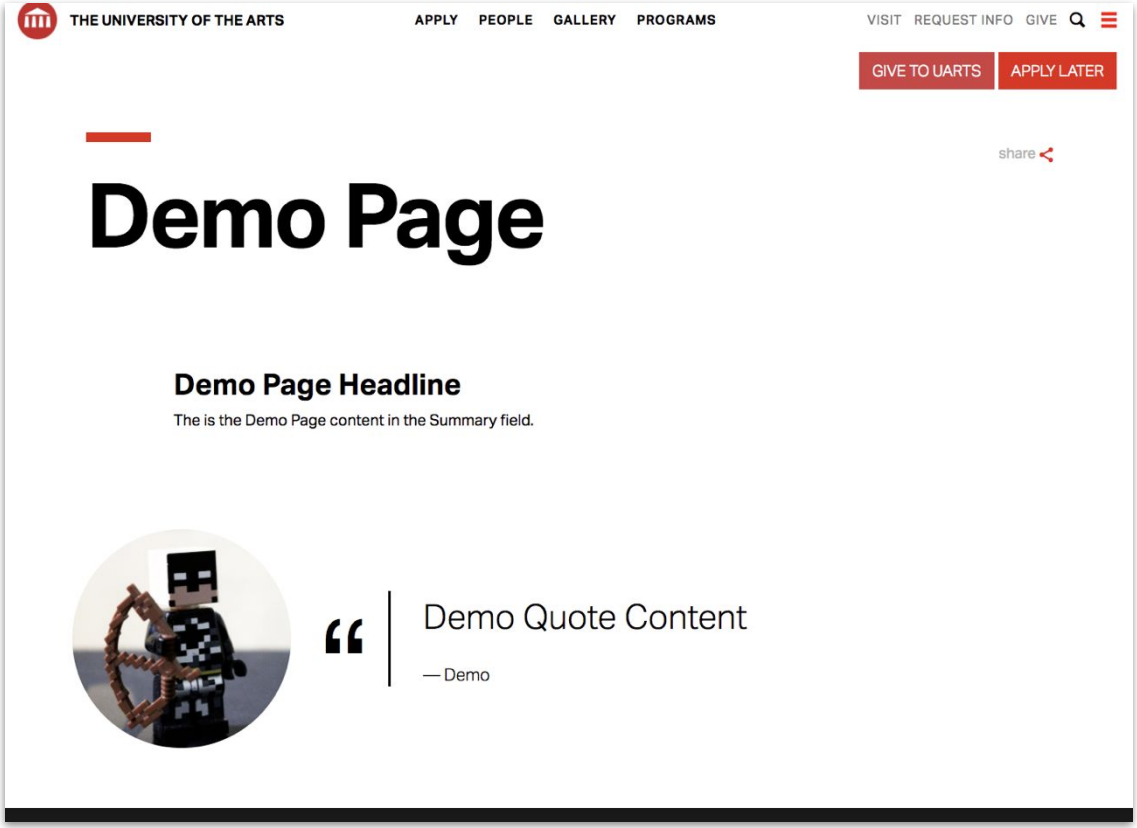
An example Paragraph type (with sample screenshot)



An example Paragraph type (form fields)



An example Paragraph type (rendered)



Theming a Paragraph field

Theming of a Paragraphs field is made possible using a template file in your theme:

- paragraph.html.twig
- paragraph- -quote.html.twig

The twig template contains markup to render each element.

- Can display each field individually

Option 2: Layout Builder and Blocks

Layout Builder module in Core

Layout Builder is new/stable in 8.7

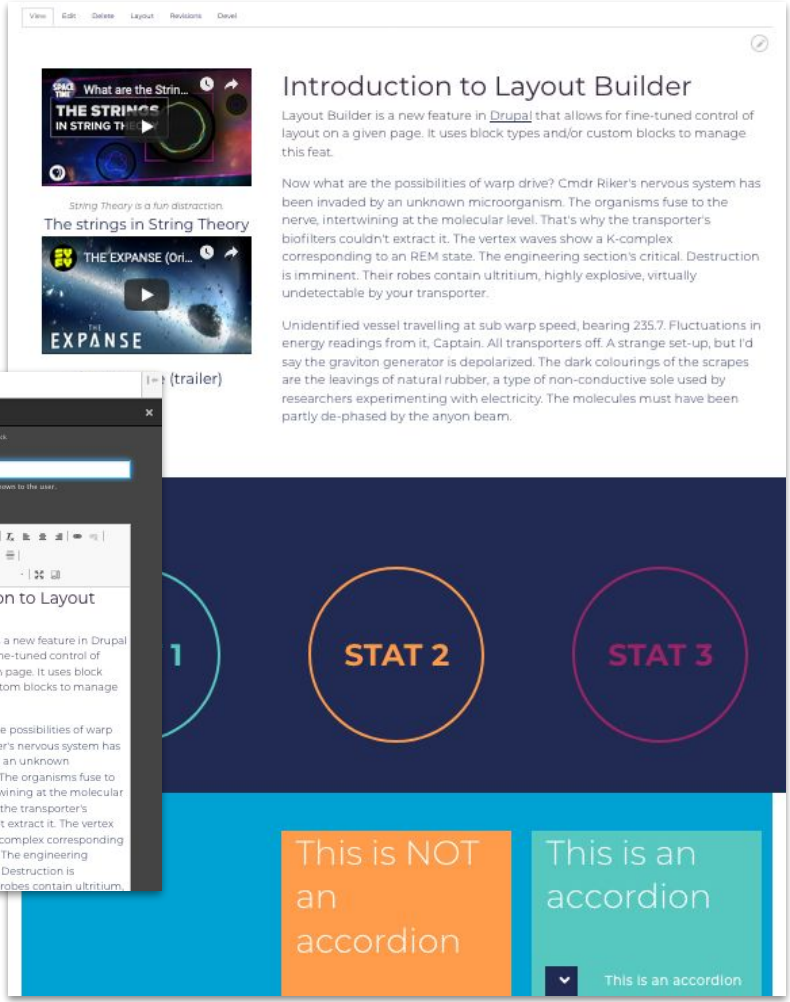
Uses Sections within a Layout

Place **any** block in a section

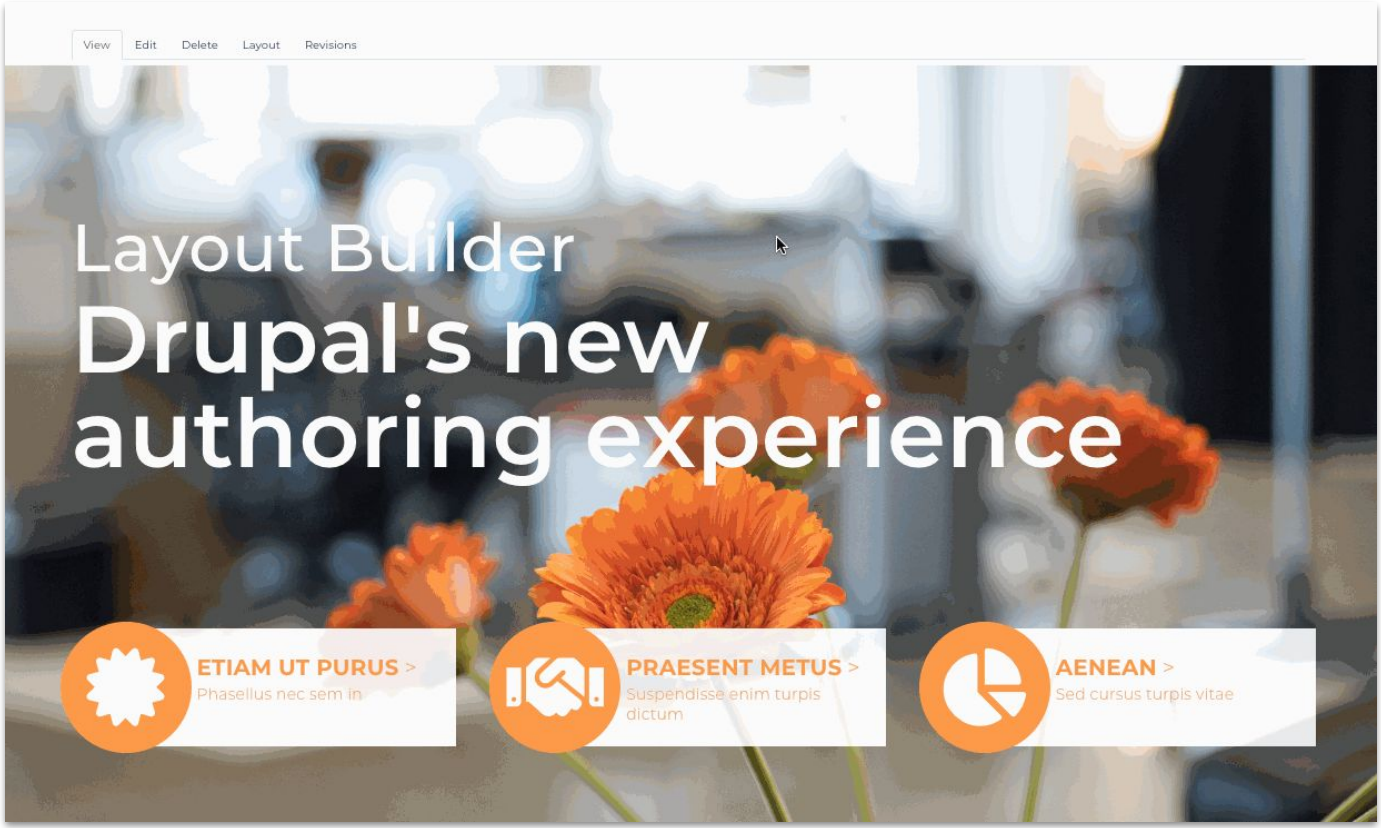
For more details about Layout Builder...
The Big, Bad Layout Builder Explainer ~ Caroline Casals

- https://www.phase2technology.com/blog/big-bad-layout

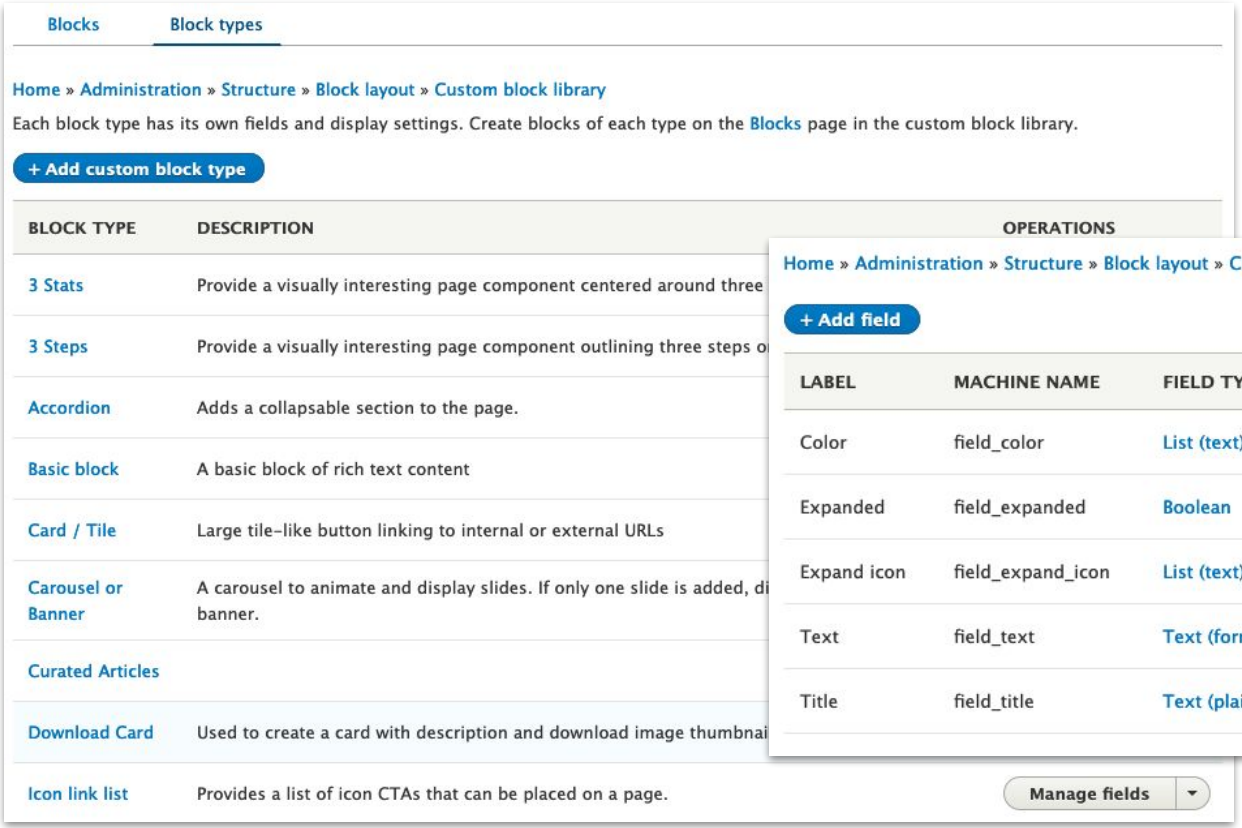
Quick introduction to Layout Builder



Layout Builder and Blocks in action



Block types and Layout Builder



Other Options for Compound Fields

Entity Construction Kit + **Inline Entity Form**

- This is the closest thing to Paragraphs using existing contrib modules

Field Collections

- “Paragraphs is likely to replace field collection for Drupal 8. Field collection is on its way to being deprecated. It is recommended to use paragraphs instead of field collection for Drupal 8 projects.”

Bricks

- Complicated to use
- More of a competitor to Panelizer

ECK+IEF Compared to Paragraphs

Entity Construction Kit with Inline Entity Form

- ECK+IEF site builder experience can be complicated
- Content editing is as easy Paragraphs
- ECK+IEF does not support revisions; problematic for editorial workflow
- Works well with Search
- Has less support in the Drupal community than Paragraphs

Custom Field API Fields

Field API in three easy steps

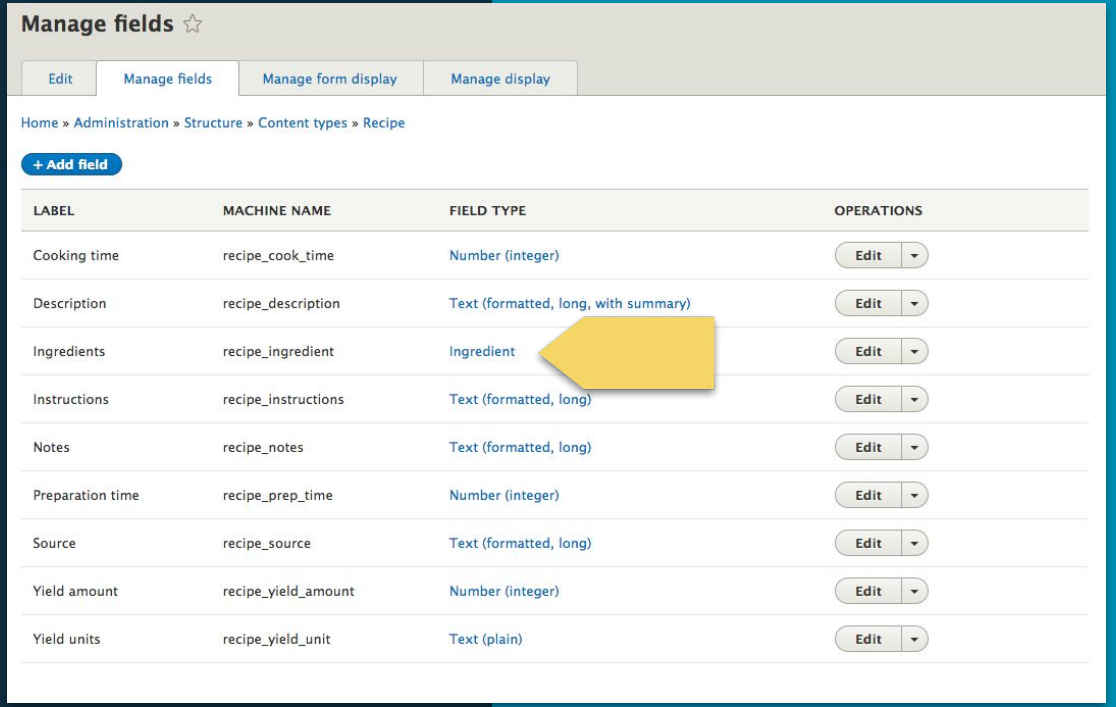
Create a custom module to add a new field.

Field Plugins

1. Field type
2. Field formatter
3. Field widget

Documentation to get started:
https://www.drupal.org/docs/8/creating-custom-modules/create-a-custom-field-type

A Custom Ingredient Field on a Recipe Node



File Structure

https://www.drupal.org/docs/8/creating-custom-modules/creating-a-custom-field

```
my_module/
     my_module.info.yml
     src/
          Plugin/
               Field/
                    FieldType/
                         MyFieldItem.php
                    FieldFormatter/
                         MyFieldFormatter.php
                    FieldWidget/
                         MyFieldWidget.php
```

Field Plugins and What They Do

- **Field Type** - Tells Drupal that the field exists and defines the database *schema* for storing the data points for the field.

- **Field Widget** - This is the *input* of the field. This is essentially a form for capturing whatever data points are needed for this field.

- **Field Formatter** - This the *output* of the field. It governs how the data can be structured for output as well as setting a template for the field's markup.

Step 1: Define the Field
Field Type

Field Type plugin - Defining a field's schema

File location

`modules/my_module/src/Plugin/Field/FieldType/myfieldtype.php`

Namespace

`\Drupal\my_module\Plugin\Field\FieldType\MyFieldType`

Annotation for Field Types

```
/**
 * Plugin implementation of the 'abilities' field type.
 *
 * @FieldType(
 *   id = "dnd_fields_abilities",
 *   label = @Translation("Abilities"),
 *   module = "dnd_fields",
 *   category = @Translation("D&D Character"),
 *   description = @Translation("Lists a PC's ability scores."),
 *   default_widget = "dnd_fields_abilities",
 *   default_formatter = "dnd_fields_abilities"
 * )
 */
class Abilities extends FieldItemBase {
  ...
  ...
}
```

Drupal 8 plugins come from Symfony, and require an annotation.

This is not *just* a comment block.

This registers the plugin with Drupal, and gives some basic context about what the plugin is and what it does.

Annotations are a method of Plugin discovery.

Define the Field Type's Schema

```
public static function schema(FieldStorageDefinitionInterface $field_definition) {
  return [
    // The columns element contains the values that the field will store.
    'columns' => [
      // List the values that the field will save. This
      // field will only save a single value, 'value'.
      'value' => [ … ],
        'type' => 'text',
        'size' => 'tiny',
        'not null' => FALSE,
      ],
    ],
  ];
}
```

Example:

```
$field_abilities[0]['value']
```

Define the Field Type's Schema

```
public static $abilities = [
  'str' => 'Strength',
  'dex' => 'Dexterity',
  'con' => 'Constitution',
  'int' => 'Intelligence',
  'wis' => 'Wisdom',
  'chr' => 'Charisma',
];
```

Class property

```
public static function schema(FieldStorageDefinitionInterface $field_definition) {
  $columns = [];

  foreach (self::$abilities as $ability => $label) {
    $columns[$ability] = [
      'description' => $label,
      'type' => 'int',
      'size' => 'tiny',
      'not null' => TRUE,
      'unsigned' => FALSE,
    ];
  }

  return [
    'description' => 'The six attribute scores for a D&D Character.',
    'columns' => $columns,
  ];
}
```

Class method

Example:

```
$field_abilities[0]['str']
$field_abilities[0]['dex']
$field_abilities[0]['wis']
```

Database Table

Entity reference fields

Base value fields

Temp value fields

- Created as `char` fields to allow for NULL values

```
MySQL [default]> describe node__field_abilities;
+--------------------------+-----------------+------+-----+---------+-------+
| Field                    | Type            | Null | Key | Default | Extra |
+--------------------------+-----------------+------+-----+---------+-------+
| bundle                   | varchar(128)    | NO   | MUL |         |       |
| deleted                  | tinyint(4)      | NO   | PRI | 0       |       |
| entity_id                | int(10) unsigned | NO   | PRI | NULL    |       |
| revision_id              | int(10) unsigned | NO   | MUL | NULL    |       |
| langcode                 | varchar(32)     | NO   | PRI |         |       |
| delta                    | int(10) unsigned | NO   | PRI | NULL    |       |
| field_abilities_str      | tinyint(4)      | YES  |     | NULL    |       |
| field_abilities_dex      | tinyint(4)      | YES  |     | NULL    |       |
| field_abilities_con      | tinyint(4)      | YES  |     | NULL    |       |
| field_abilities_int      | tinyint(4)      | YES  |     | NULL    |       |
| field_abilities_wis      | tinyint(4)      | YES  |     | NULL    |       |
| field_abilities_chr      | tinyint(4)      | YES  |     | NULL    |       |
| field_abilities_temp_str | char(2)         | YES  |     | NULL    |       |
| field_abilities_temp_dex | char(2)         | YES  |     | NULL    |       |
| field_abilities_temp_con | char(2)         | YES  |     | NULL    |       |
| field_abilities_temp_int | char(2)         | YES  |     | NULL    |       |
| field_abilities_temp_wis | char(2)         | YES  |     | NULL    |       |
| field_abilities_temp_chr | char(2)         | YES  |     | NULL    |       |
+--------------------------+-----------------+------+-----+---------+-------+
18 rows in set (0.04 sec)
```

Other Class Methods

- **schema** - Defines the database schema
- **propertyDefinitions** - Allows for field settings; such as choosing between Imperial and Metric units (or both) for an Ingredient's unit value.
- **isEmpty** - This checks if the system has any field values for this field type. This is used when trying to modify a field instance's settings; it won't allow it if there is already data for the field.

Step 2: Define Input Field Widget

Field Widget plugin - Defining a field's input

File location

`modules/my_module/src/Plugin/Field/FieldWidget/MyFieldTtypeWidget.php`

Namespace

`\Drupal\my_module\Plugin\Field\FieldWidget\MyFieldTypeWidget`

Annotation for Field Widgets

```
/**
 * Plugin implementation of the 'dnd_fields_abilities' widget.
 *
 * @FieldWidget(
 *   id = "dnd_fields_abilities",
 *   module = "dnd_fields",
 *   label = @Translation("D&D Character Abilities"),
 *   field_types = {
 *     "dnd_fields_abilities"
 *   }
 * )
 */
class AbilitiesWidget extends WidgetBase {
  ...
  ...
  ...
}
```

This widget can apply to more than just the Abilities field type.

A custom field widget plugin can be a standalone plugin that just adds new widgets to existing field types.

FieldTypes and FieldWidgets can have a many-to-many relationship.

Define the Field Widget Form

```
public function formElement(FieldItemListInterface $items, $delta, array $element, array &$form, FormStateInterface $form_state)
  // Set up the form element for this widget as a table.
  $element += [
    '#type' => 'table',
    '#header' => [
      $this->t('Ability'),
      $this->t('Base value'),
      $this->t('Temp value'),
    ],
    '#element_validate' => [
      [$this, 'validate'],
    ],
  ];

  // Add in the attribute textfield elements.
  foreach ([
    'str' => $this->t('Strength'),
    'dex' => $this->t('Dexterity'),
    'con' => $this->t('Constitution'),
    'int' => $this->t('Intelligence'),
    'wis' => $this->t('Wisdom'),
    'chr' => $this->t('Charisma'),
  ] as $attribute => $title) {

  $element[$attribute]['label'] = [
    '#type' => 'label',
    '#title' => $title,
```

Define the Field Widget Form

```
...
  // Add in the attribute textfield elements.
  foreach ([
    'str' => $this->t('Strength'),
    'dex' => $this->t('Dexterity'),
    'con' => $this->t('Constitution'),
    'int' => $this->t('Intelligence'),
    'wis' => $this->t('Wisdom'),
    'chr' => $this->t('Charisma'),
  ] as $attribute => $title) {

    $element[$attribute]['label'] = [
      '#type' => 'label',
      '#title' => $title,
    ];

    $element[$attribute][$attribute] = [
      '#type' => 'textfield',
      '#size' => 2,
      '#default_value' => $items[$delta]->$attribute,
      '#attributes' => ['class' => ['dnd-fields-abilities-entry']],
      '#field_suffix' => '<span></span>',
    ];
```

Define the Field Widget Form

```
...
    $element[$attribute][$temp_value] = [
      '#type' => 'textfield',
      '#size' => 2,
      '#default_value' => $items[$delta]->$temp_value,
      '#attributes' => ['class' => ['dnd-fields-abilities-entry']],
      '#field_suffix' => '<span></span>',
    ];

    // Since Form API doesn't allow a fieldset to be required, we
    // have to require each field element individually.
    if ($element['#required']) {
      $element[$attribute]['#required'] = TRUE;
    }
  }

  $element['#attached'] = [
  // Add javascript to manage the bonus values for attributes as they're
  // entered into to the field elements.
    'library' => [
      'dnd_fields/abilities_widget',
    ],
  ];

  return $element;
}
```

Abilities Field Widget

Ability (label)

Base Value

Temp Value

jQuery adds bonus or penalties in realtime as users enter ability scores

ABILITY	BASE VALUE	TEMP VALUE
Strength	9 -1	
Dexterity	11 0	
Constitution	12 +1	14 +2
Intelligence	19 +4	
Wisdom	16 +3	
Charisma	12 +1	

Other Class Methods

- **formElement** - This defines the widget similar to Form API form arrays. This is how Javascript elements can be attached to the field's element. (*required*)
- **validate** - Just like a Form API form, this is the form validator that is executed when the form is submitted.
- **defaultSettings** - Allows for default values for this widget.
- **settingsForm** - The form used to allow admins to change widget settings.
- **settingsSummary** - Block of markup describing the settings.

Step 3: Define Output Field Formatter

Field Formatter plugin - Defining a field's output

File location

`modules/my_module/src/Plugin/Field/FieldFormatter/MyFieldTypeFormatter.php`

Namespace

`\Drupal\my_module\Plugin\Field\FieldFormatter\MyFieldTypeFormatter`

Annotation for Field Formatters

```
/**
 * Plugin implementation of the dnd_fields Abilities formatter.
 *
 * @FieldFormatter(
 *   id = "dnd_fields_abilities",
 *   label = @Translation("D&D Character Abilities"),
 *   field_types = {
 *     "dnd_fields_abilities"
 *   }
 * )
 */
class AbilitiesFormatter extends FormatterBase {
  ...
  ...
  ...
}
```

This formatter can apply to more than just a specific field type.

This formatter can apply to any field type, provided it is capable of accessing each of the field's element values.

Define the Field Formatter Output

```
class AbilitiesFormatter extends FormatterBase {

  public static $abilities = [
    'str' => 'Strength',
    'dex' => 'Dexterity',
    'con' => 'Constitution',
    'int' => 'Intelligence',
    'wis' => 'Wisdom',
    'chr' => 'Charisma',
  ];

  public function viewElements(FieldItemListInterface $items, $langcode) {
    $element = [];

    // The $delta is for supporting multiple field cardinality. We don't expect
    // to have to worry about that here, but let's support it just in case.
    foreach ($items as $delta => $item) {
      $header = [
        $this->t('Ability'),
        $this->t('Base Score'),
        $this->t('Base Modifier'),
        $this->t('Temporary Score'),
        $this->t('Temporary Modifier'),
      ];

      $rows = [];
```

Define the Field Formatter Output

```
...
    $rows = [];

    foreach (self::$abilities as $ability => $label) {
      $temp_ability = 'temp_' . $ability;
      $temp_value = $item->$temp_ability;

      $rows[$ability]['label'] = $this->t($label);
      $rows[$ability]['base_score'] = $item->$ability;
      $rows[$ability]['base_modifier'] = floor(($item->$ability - 10) / 2);
      $rows[$ability]['temp_score'] = $item->$temp_ability;
      $rows[$ability]['temp_modifier'] = (is_numeric($item->$temp_ability))
          ? floor(((int)$item->$temp_ability - 10) / 2) : NULL;

      $element[$delta] = [
        '#type' => 'table',
        '#header' => $header,
        '#rows' => $rows,
      ];

      }
    }

    return $element;
  }
}
```

Abilities Field Formatter

Displayed as tabular data, but any theme function can be used

This is a single field instance

Abilities

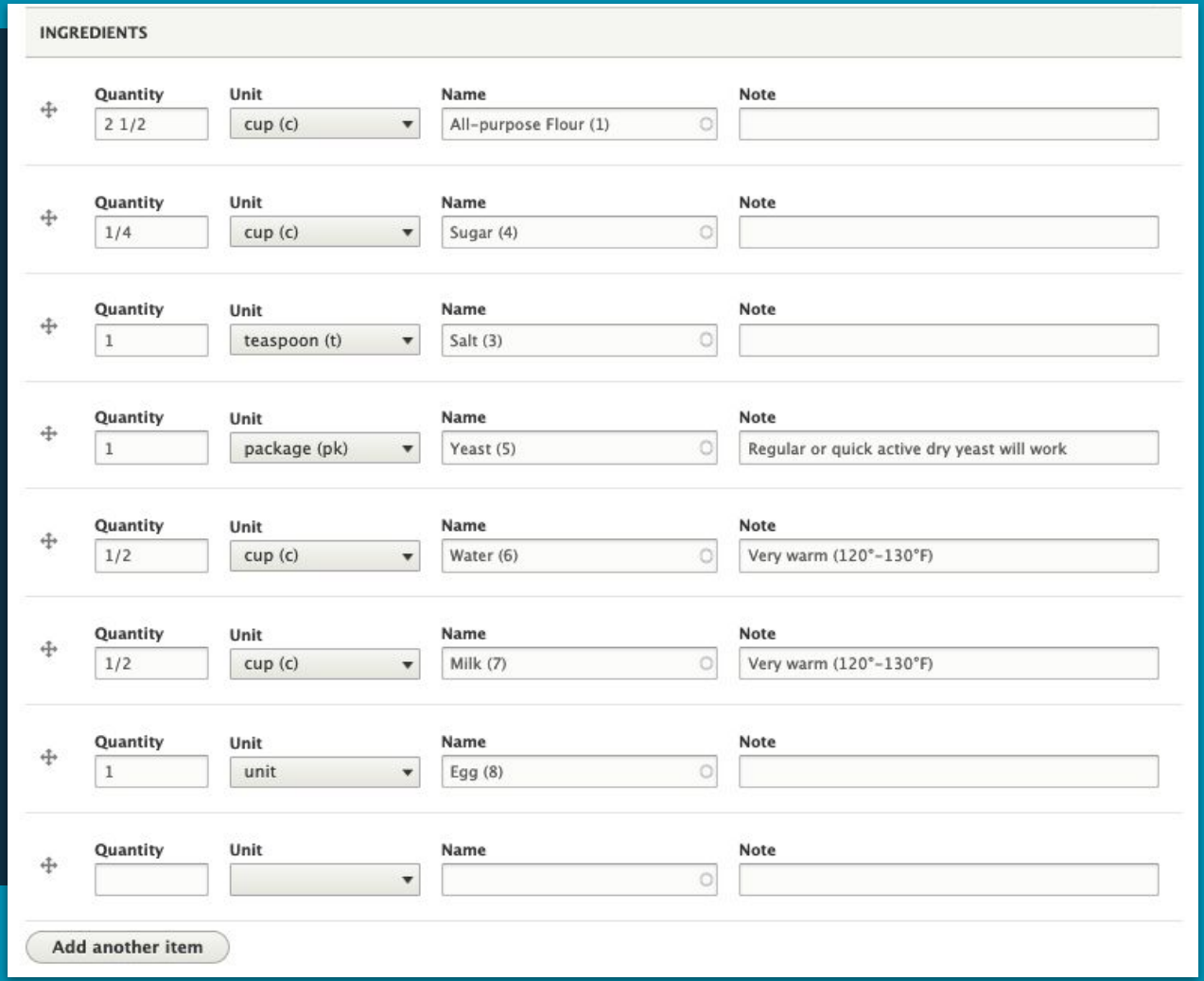
Ability	Base Score	Base Modifier	Temporary Score	Temporary Modifier
Strength	9	-1	0	-5
Dexterity	12	1	14	2
Constitution	11	0		
Intelligence	19	4		
Wisdom	15	2		
Charisma	16	3		

Ingredients List (again)

Single Field instance

Infinite cardinality allows for “Add another item”

Each new item is represented by a field’s delta



Abilities
Field Formatter

Recipe has a single field instance for Ingredients

Ingredients have infinite cardinality

This Ingredient field has a delta from 0-8

Homemade Pan Rolls

★★★★½ 84 Ratings 44 Comments

Prep	Total	Servings
30 MIN	2 HR 18 MIN	4

One whiff of these fragrant rolls, and you'll be counting the moments until you can take them out of the oven!

Ingredients

- 2 1/2 to 3 cups All-purpose flour
- 1/4 cup sugar
- 1/4 cup shortening
- 1 teaspoon salt
- 1 package regular or quick active dry yeast
- 1/2 cup very warm water (120°F to 130°F)
- 1/2 cup very warm milk (120°F to 130°F)
- 1 egg
- Butter or margarine, melted

Steps

Other Class Methods

- **viewElements** - Returns a renderable array of the field's value(s).
- **defaultSettings** - Allows for default values for this formatter.
- **settingsForm** - The form used to allow admins to change widget settings.
- **settingsSummary** - Block of markup describing the settings.

Theming Fields

Twig Templates for Fields

Theming of any field is made possible using a template file in your theme or module:

- Based on field.html.twig
- field- -ingredient.html.twig
- field- -abilities.html.twig

The twig template contains markup to render each element.

#theme=>'ingredient' in the Field Formatter tells Drupal to use the theme_ingredient, an

Field and hook_theme

```
/**
 * Implements hook_theme().
 */
function ingredient_theme($existing, $type, $theme, $path) {
  $theme = [
    'ingredient' => [
      'variables' => [
        'quantity' => NULL,
        'unit' => NULL,
        'name' => NULL,
        'note' => NULL,
      ],
    ],
  ];

  return $theme;
}
```

This creates uses the module's implementation of hook_theme to register a new theme key called 'ingredient'.

This will allow for a new template called 'ingredient.html.twig' to be used for theming Ingredient fields.

An Example of a Field Kernel Test

Kernel Test

```
class AbilitiesFieldTest extends FieldKernelTestBase {

  public static $modules = ['dnd_fields'];

  /**
   * Modules to enable.
   *
   * @var array
   */
  protected function setUp() {
    parent::setUp();

    // Create a dnd_fields Abilities field storage and field for validation.
    FieldStorageConfig::create([
      'field_name' => 'field_test',
      'entity_type' => 'entity_test',
      'type' => 'dnd_fields_abilities',
    ])->save();

    FieldConfig::create([
      'entity_type' => 'entity_test',
      'field_name' => 'field_test',
      'bundle' => 'entity_test',
    ])->save();
  }
 ...
```

Kernel Test Setup

```
/**
 * Tests using entity fields of the dnd_fields Abilities field type.
 */
public function testAbilitiesField() {
  // Verify entity creation.
  $entity = EntityTest::create();

  $values = [
    'str' => rand(3, 18),
    'dex' => rand(3, 18),
    'con' => rand(3, 18),
    'int' => rand(3, 18),
    'wis' => rand(3, 18),
    'chr' => rand(3, 18),
  ];
  foreach ($values as $attribute => $value) {
    $values['temp_' . $attribute] = $value + rand(-2, 2);
  }

  $entity->field_test = $values;

  foreach ($values as $attribute => $value) {
    $entity->name->$attribute = $value;
  }

  $entity->save();
```

Kernel Test Assertions

```
...

  // Verify entity has been created properly.
  $id = $entity->id();

  $entity = EntityTest::load($id);

  $this->assertTrue($entity->field_test instanceof FieldItemListInterface, 'Field implements interface.');
  $this->assertTrue($entity->field_test[0] instanceof FieldItemInterface, 'Field item implements interface.');

  foreach ($values as $attribute => $value) {
    $this->assertEqual($entity->field_test->$attribute, $value);
    $this->assertEqual($entity->field_test[0]->$attribute, $value);
  }

...
```

Kernel Test - Changing Values

```
...
  // Verify changing the field value.
  $new_values = [
    'str' => rand(3, 18),
    'dex' => rand(3, 18),
    'con' => rand(3, 18),
    'int' => rand(3, 18),
    'wis' => rand(3, 18),
    'chr' => rand(3, 18),
  ];
  foreach ($new_values as $attribute => $value) {
    $values['temp_' . $attribute] = $value + rand(-2, 2);
  }

  $entity->field_test = $new_values;
  foreach ($new_values as $new_attribute => $new_value) {
    $this->assertEqual($entity->field_test->$new_attribute, $new_value);
    $this->assertEqual($entity->field_test[0]->$new_attribute, $new_value);
  }

  // Read changed entity and assert changed values.
  $entity->save();
  $entity = EntityTest::load($id);
  foreach ($new_values as $new_attribute => $new_value) {
    $this->assertEqual($entity->field_test->$new_attribute, $new_value);
    $this->assertEqual($entity->field_test[0]->$new_attribute, $new_value);
  }
}
```

Blog Post

Coming Soon...

www.phase2technology.com/blog
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What did you think?

events.drupal.org/seattle2019/sessions/custom-compound-fields-drupal-8

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Join us for contribution opportunities

Friday, April 12, 2019

Mentored Contribution

9:00-18:00
Room: 602

First Time Contributor Workshop

9:00-12:00
Room: 606

General Contribution

9:00-18:00
Room: 6A

Questions?

thank you

Come see us at
BOOTH 201

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