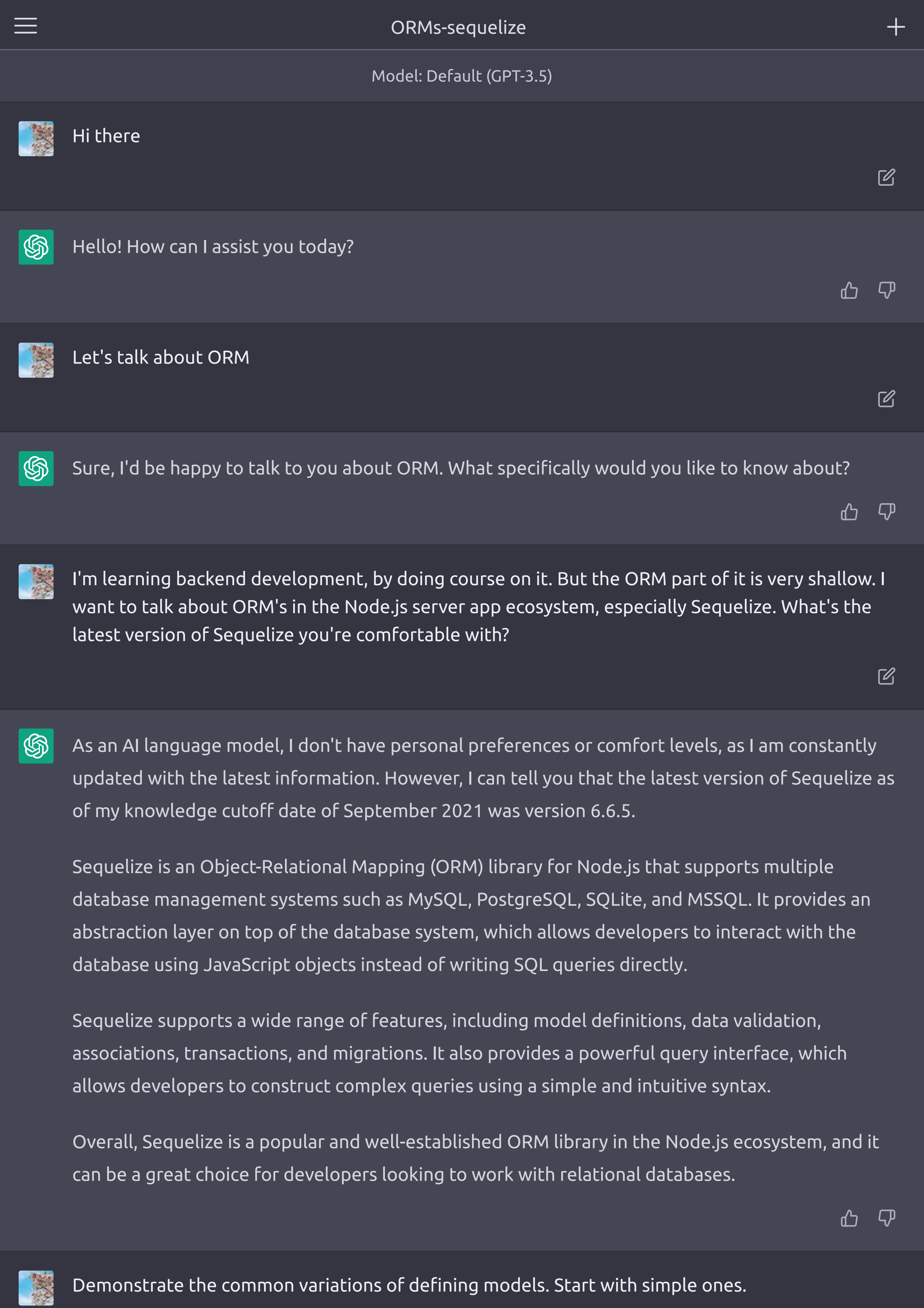


ORMs-sequelize

Model: Default (GPT-3.5)

Hi there

Hello! How can I assist you today?

Let's talk about ORM

Sure, I'd be happy to talk to you about ORM. What specifically would you like to know about?

I'm learning backend development, by doing course on it. But the ORM part of it is very shallow. I want to talk about ORM's in the Node.js server app ecosystem, especially Sequelize. What's the latest version of Sequelize you're comfortable with?

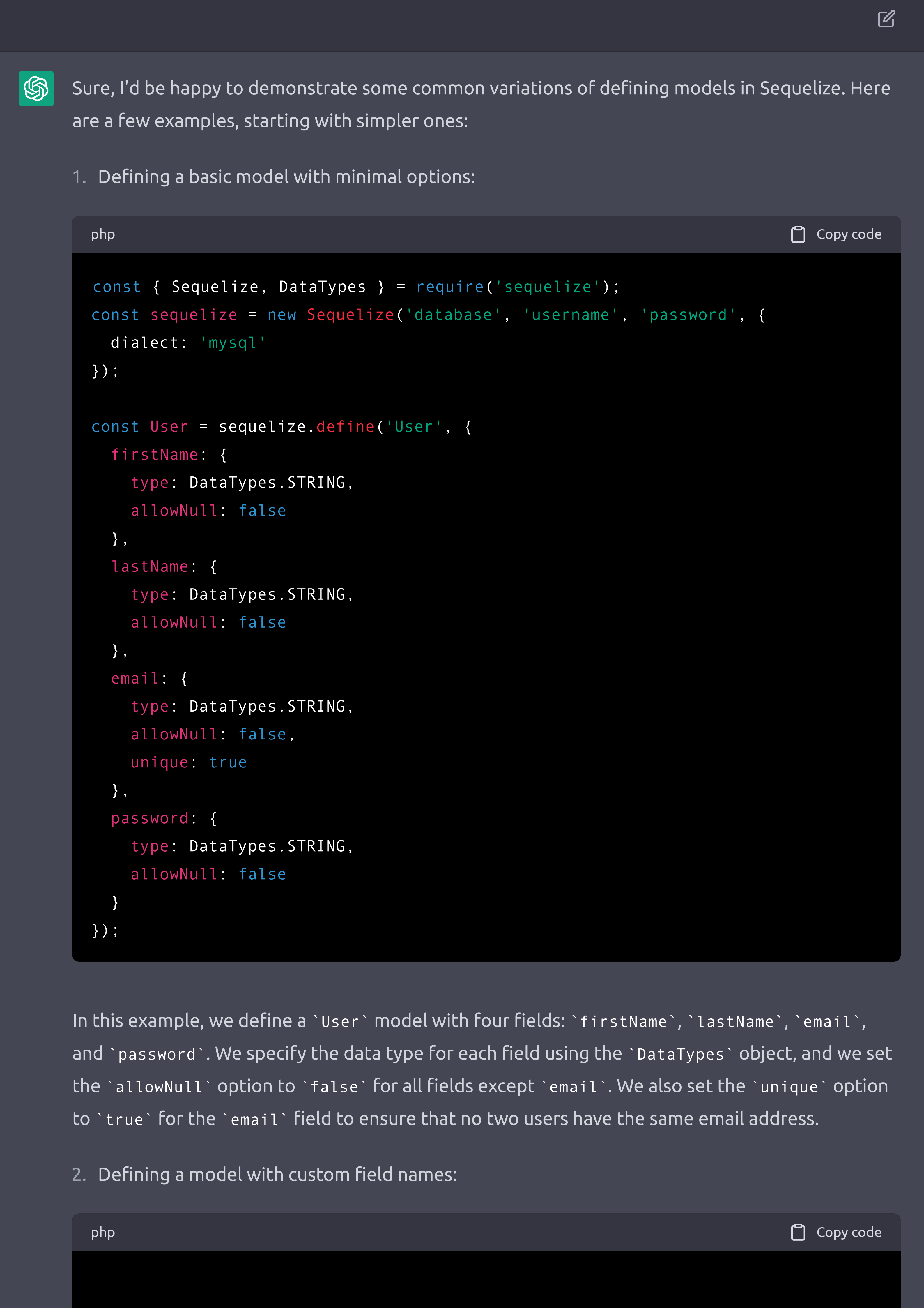
As an AI language model, I don't have personal preferences or comfort levels, as I am constantly updated with the latest information. However, I can tell you that the latest version of Sequelize as of my knowledge cutoff date of September 2021 was version 6.6.5.

Sequelize is an Object-Relational Mapping (ORM) library for Node.js that supports multiple database management systems such as MySQL, PostgreSQL, SQLite, and MSSQL. It provides an abstraction layer on top of the database system, which allows developers to interact with the database using JavaScript objects instead of writing SQL queries directly.

Sequelize supports a wide range of features, including model definitions, data validation, associations, transactions, and migrations. It also provides a powerful query interface, which allows developers to construct complex queries using a simple and intuitive syntax.

Overall, Sequelize is a popular and well-established ORM library in the Node.js ecosystem, and it can be a great choice for developers looking to work with relational databases.

Demonstrate the common variations of defining models. Start with simple ones.



Sure, I'd be happy to demonstrate some common variations of defining models in Sequelize. Here are a few examples, starting with simpler ones:

1. Defining a basic model with minimal options:

```
const { Sequelize, DataTypes } = require('sequelize');
const sequelize = new Sequelize('database', 'username', 'password', {
  dialect: 'mysql'
});

const User = sequelize.define('User', {
  firstName: {
    type: DataTypes.STRING,
    allowNull: false
  },
  lastName: {
    type: DataTypes.STRING,
    allowNull: false
  },
  email: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false
  }
});
```

In this example, we define a `User` model with four fields: `firstName`, `lastName`, `email`, and `password`. We specify the data type for each field using the `DataTypes` object, and we set the `allowNull` option to `false` for all fields except `email`. We also set the `unique` option to `true` for the `email` field to ensure that no two users have the same email address.

2. Defining a model with custom field names:

```
const { Sequelize, DataTypes } = require('sequelize');
const sequelize = new Sequelize('database', 'username', 'password', {
  dialect: 'mysql'
});

const User = sequelize.define('User', {
  firstName: {
    type: DataTypes.STRING,
    field: 'first_name',
    allowNull: false
  },
  lastName: {
    type: DataTypes.STRING,
    field: 'last_name',
    allowNull: false
  },
  email: {
    type: DataTypes.STRING,
    field: 'email_address',
    allowNull: false,
    unique: true
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false
  }
});
```

In this example, we define a `User` model with four fields, but we also specify custom field names using the `field` option. For example, the `firstName` field is mapped to the `first_name` column in the database, and the `lastName` field is mapped to the `last_name` column.

3. Defining a model with virtual fields:

javascript Copy code

```javascript
const { Sequelize, DataTypes } = require('sequelize');
const sequelize = new Sequelize('database', 'username', 'password', {
  dialect: 'mysql'
});

const User = sequelize.define('User', {
  firstName: {
    type: DataTypes.STRING,
    allowNull: false
  },
  lastName: {
    type: DataTypes.STRING,
    allowNull: false
  }
}, {
  getterMethods: {
    fullName() {
      return this.firstName + ' ' + this.lastName;
    }
  },
  setterMethods: {
    fullName(value) {
      const names = value.split(' ');
      this.setDataValue('firstName', names.slice(0, -1).join(' '));
      this.setDataValue('lastName', names.slice(-1).join(' '));
    }
  }
});
```

In this example, we define a `User` model with two fields: `firstName` and `lastName`. We also define two virtual fields using the `getterMethods` and `setterMethods` options: `fullName` and `fullName`. The `fullName` getter method concatenates the `firstName` and `lastName` fields, while the `fullName` setter method splits a full name string into first and last names and sets the corresponding fields.

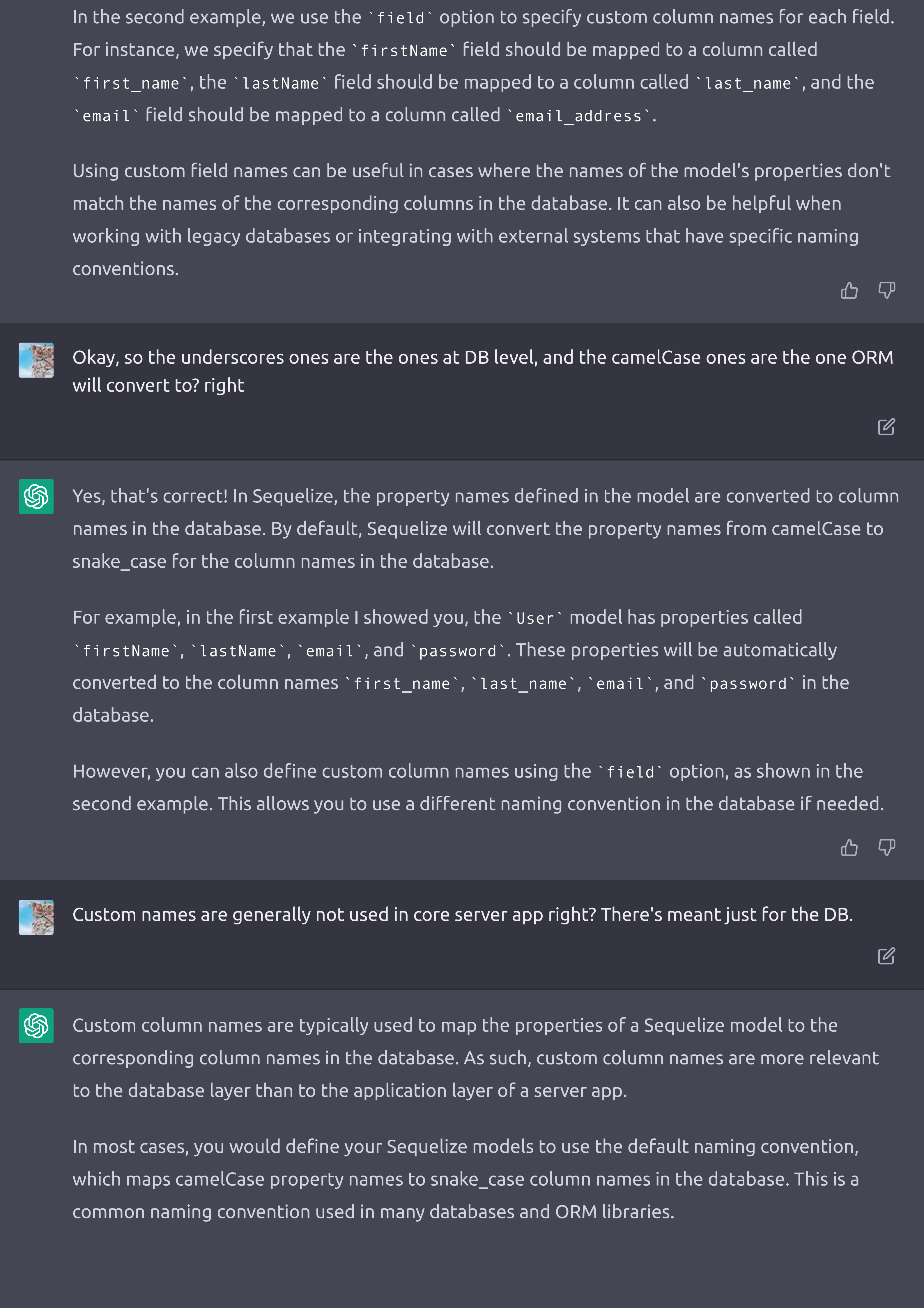
These are just a few examples of the different ways you can define models in Sequelize. Depending on your application's needs, you may need to use more advanced options such

Can you exlain the second one again. what's a custom field?

Sure, I'd be happy to explain the second example again.

In Sequelize, a custom field is a database column that is given a specific name using the `field` option in the model definition. By default, Sequelize uses the name of the model's property to name the corresponding column in the database.

For example, in the first example I showed you, the `User` model has a property called `firstName`, which is mapped to a database column called `firstName`. Similarly, the `lastName` property is mapped to a column called `lastName`.



In the second example, we use the `field` option to specify custom column names for each field. For instance, we specify that the `firstName` field should be mapped to a column called `first_name`, the `lastName` field should be mapped to a column called `last_name`, and the `email` field should be mapped to a column called `email_address`.

Using custom field names can be useful in cases where the names of the model's properties don't match the names of the corresponding columns in the database. It can also be helpful when working with legacy databases or integrating with external systems that have specific naming conventions.

Okay, so the underscores ones are the ones at DB level, and the camelCase ones are the one ORM will convert to? right

Yes, that's correct! In Sequelize, the property names defined in the model are converted to column names in the database. By default, Sequelize will convert the property names from camelCase to snake_case for the column names in the database.

For example, in the first example I showed you, the `User` model has properties called `firstName`, `lastName`, `email`, and `password`. These properties will be automatically converted to the column names `first_name`, `last_name`, `email`, and `password` in the database.

However, you can also define custom column names using the `field` option, as shown in the second example. This allows you to use a different naming convention in the database if needed.

Custom names are generally not used in core server app right? There's meant just for the DB.

Custom column names are typically used to map the properties of a Sequelize model to the corresponding column names in the database. As such, custom column names are more relevant to the database layer than to the application layer of a server app.

In most cases, you would define your Sequelize models to use the default naming convention, which maps camelCase property names to snake_case column names in the database. This is a common naming convention used in many databases and ORM libraries.

However, there may be cases where you need to use custom column names in your Sequelize models. For example, if you're working with a legacy database that uses a different naming convention, or if you're integrating with an external system that has specific naming requirements.

In such cases, defining custom column names in your Sequelize models can be useful. But as a general rule, it's best to stick to the default naming convention unless you have a compelling reason to do otherwise.

Okay, so in general, the developer doesn't have to worry about custom field names, right, atleast when developing the primary app code?

Yes, in general, developers do not have to worry about custom field names when developing the primary app code using Sequelize. Sequelize will automatically generate default column names based on the property names defined in the model.

The default column names generated by Sequelize follow a naming convention of using snake_case, which is a commonly used convention for naming database columns. This naming convention allows Sequelize to easily map model properties to database columns and vice versa.

However, there may be cases where you need to use custom field names, such as when working with legacy databases or integrating with external systems that use specific naming conventions. In these cases, you would need to define custom field names in your Sequelize models.

But for most use cases, you can rely on Sequelize to generate default column names and use them in your application without worrying about custom field names.

One can alternatively use the field names (that you set) directly as the keys of the model, that's fine too, right?

Yes, that's correct! When you define custom field names for your Sequelize model using the `field` option, you can use those field names directly as keys in your model.

For example, in the second example I showed you, we defined a `User` model with custom field names:

php Copy code

```
const User = sequelize.define('User', {
  firstName: {
    type: DataTypes.STRING,
    field: 'first_name',
    allowNull: false
  },
  lastName: {
    type: DataTypes.STRING,
    field: 'last_name',
    allowNull: false
  },
  email: {
    type: DataTypes.STRING,
    field: 'email_address',
    allowNull: false,
    unique: true
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false
  }
});
```

In this example, we defined custom field names for the `firstName`, `lastName`, and `email` fields using the `field` option.

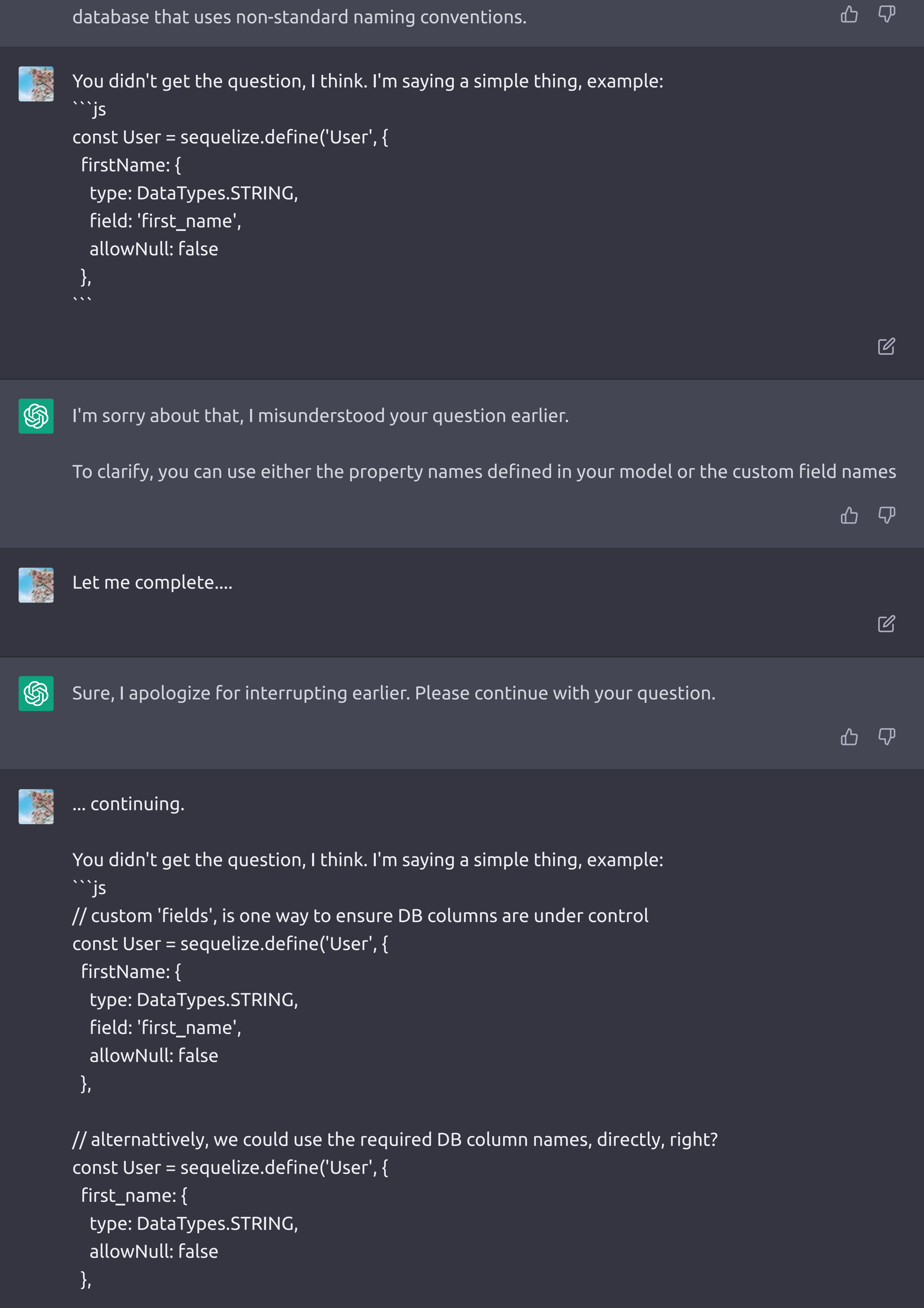
To use these fields in your code, you can simply refer to them by their custom field names:

php Copy code

```
const user = await User.create({
  first_name: 'John',
  last_name: 'Doe',
  email_address: 'john.doe@example.com',
  password: 'password'
});
```

In this example, we create a new `User` instance and set the `first_name`, `last_name`, `email_address`, and `password` fields using their custom field names.

Using custom field names in this way can be useful in cases where you need to integrate with external systems that have specific naming conventions, or if you're working with a legacy



database that uses non-standard naming conventions.

You didn't get the question, I think. I'm saying a simple thing, example:

~~~
```js
const User = sequelize.define('User', {
 firstName: {
   type: DataTypes.STRING,
   field: 'first_name',
   allowNull: false
 },
```
~~~

I'm sorry about that, I misunderstood your question earlier.

To clarify, you can use either the property names defined in your model or the custom field names

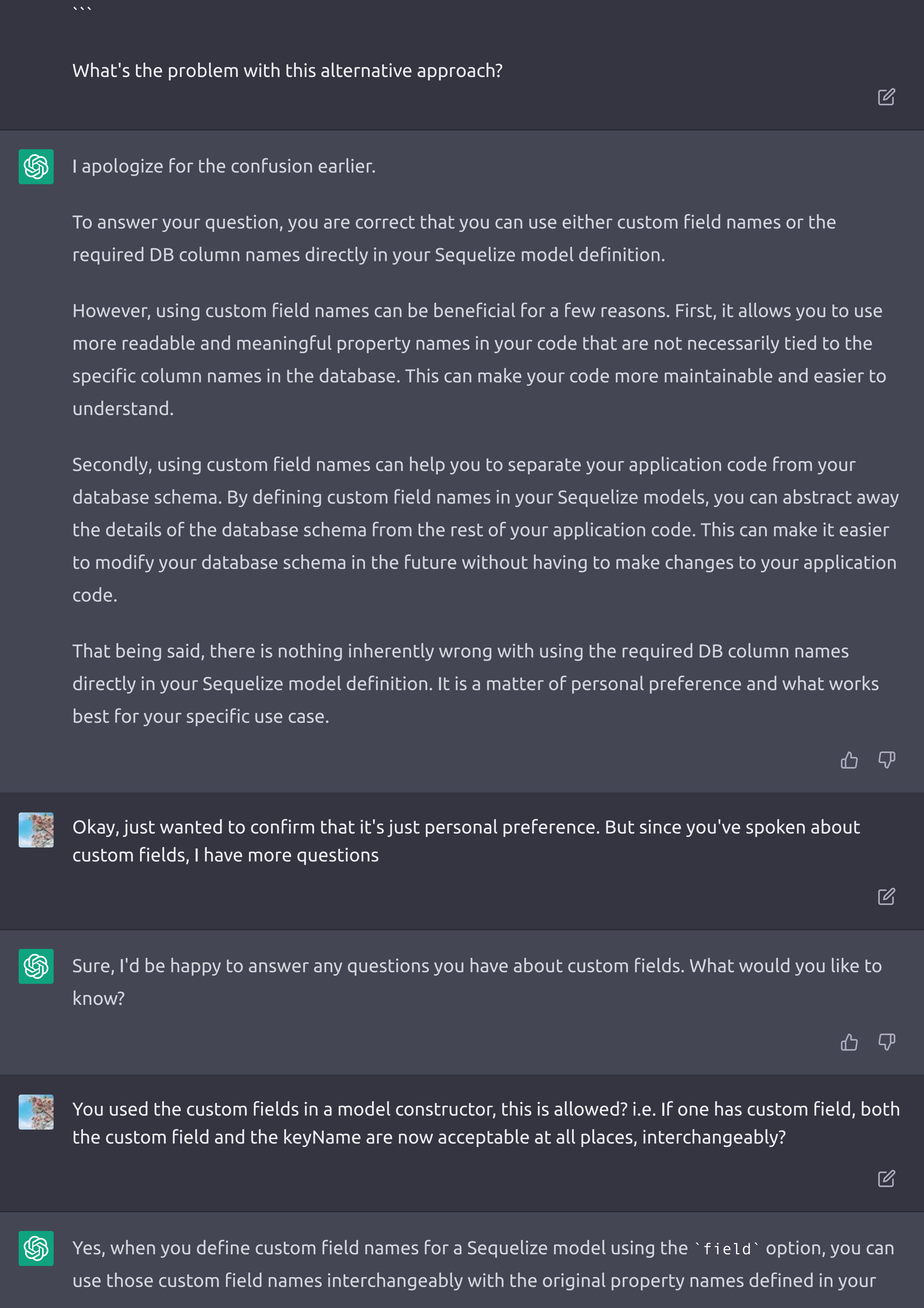
Let me complete....

Sure, I apologize for interrupting earlier. Please continue with your question.

... continuing.

You didn't get the question, I think. I'm saying a simple thing, example:

~~~
```js
// custom 'fields', is one way to ensure DB columns are under control
const User = sequelize.define('User', {
 firstName: {
   type: DataTypes.STRING,
   field: 'first_name',
   allowNull: false
 },

// alternattively, we could use the required DB column names, directly, right?
const User = sequelize.define('User', {
 first_name: {
   type: DataTypes.STRING,
   allowNull: false
 },
~~~



```

What's the problem with this alternative approach?

I apologize for the confusion earlier.

To answer your question, you are correct that you can use either custom field names or the required DB column names directly in your Sequelize model definition.

However, using custom field names can be beneficial for a few reasons. First, it allows you to use more readable and meaningful property names in your code that are not necessarily tied to the specific column names in the database. This can make your code more maintainable and easier to understand.

Secondly, using custom field names can help you to separate your application code from your database schema. By defining custom field names in your Sequelize models, you can abstract away the details of the database schema from the rest of your application code. This can make it easier to modify your database schema in the future without having to make changes to your application code.

That being said, there is nothing inherently wrong with using the required DB column names directly in your Sequelize model definition. It is a matter of personal preference and what works best for your specific use case.

Okay, just wanted to confirm that it's just personal preference. But since you've spoken about custom fields, I have more questions

Sure, I'd be happy to answer any questions you have about custom fields. What would you like to know?

You used the custom fields in a model constructor, this is allowed? i.e. If one has custom field, both the custom field and the keyName are now acceptable at all places, interchangeably?

Yes, when you define custom field names for a Sequelize model using the `field` option, you can use those custom field names interchangeably with the original property names defined in your
```

model.

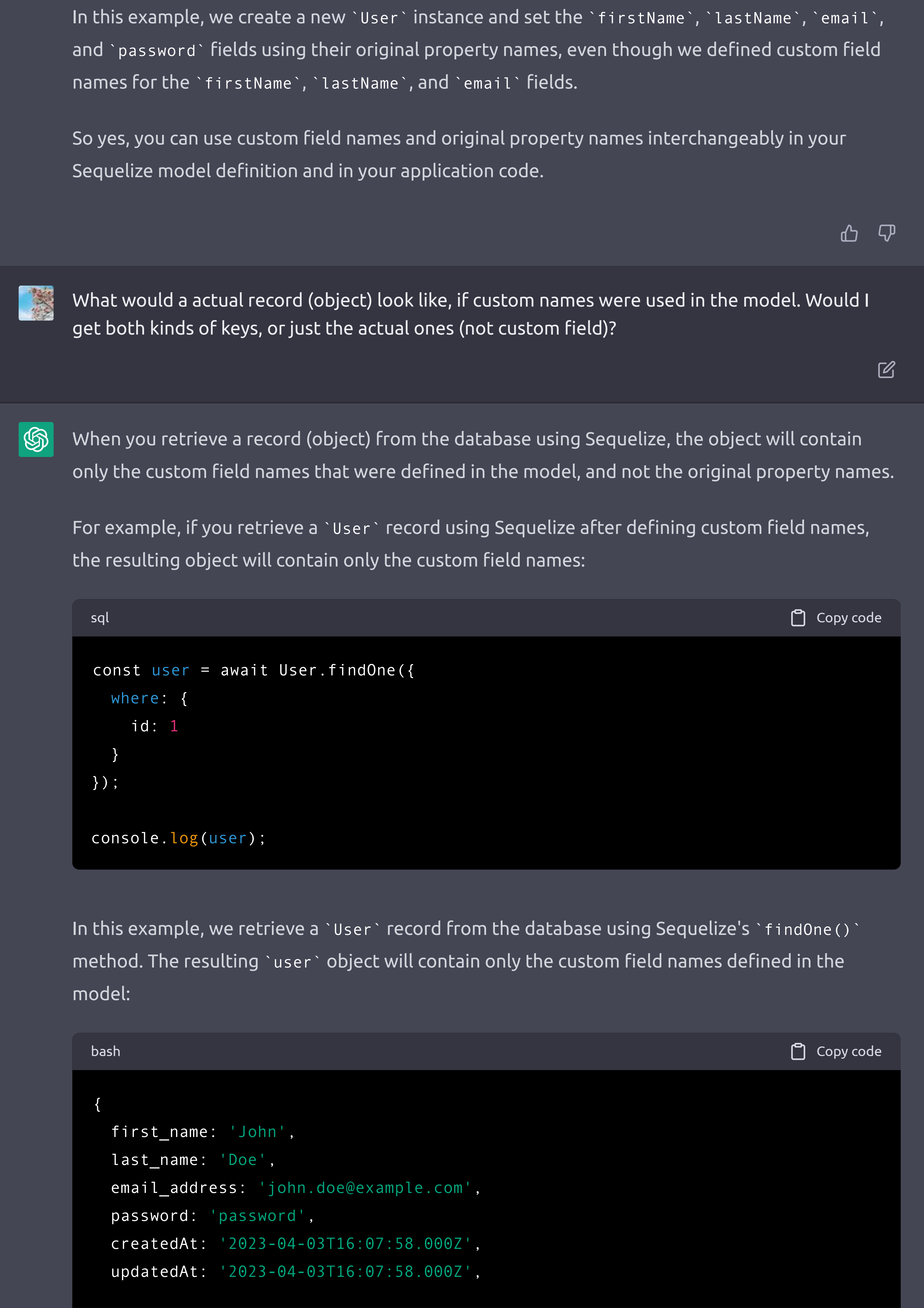
For example, in the second example I showed you earlier, we defined a `User` model with custom field names:

```php
const User = sequelize.define('User', {
  firstName: {
    type: DataTypes.STRING,
    field: 'first_name',
    allowNull: false
  },
  lastName: {
    type: DataTypes.STRING,
    field: 'last_name',
    allowNull: false
  },
  email: {
    type: DataTypes.STRING,
    field: 'email_address',
    allowNull: false,
    unique: true
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false
  }
});
```

In this example, we defined custom field names for the `firstName`, `lastName`, and `email` fields using the `field` option.

To use these fields interchangeably with the original property names, you can refer to them by either their custom field names or their original property names:

```php
const user = await User.create({
  firstName: 'John',
  lastName: 'Doe',
  email: 'john.doe@example.com',
  password: 'password'
});
```



In this example, we create a new `User` instance and set the `firstName`, `lastName`, `email`, and `password` fields using their original property names, even though we defined custom field names for the `firstName`, `lastName`, and `email` fields.

So yes, you can use custom field names and original property names interchangeably in your Sequelize model definition and in your application code.

What would a actual record (object) look like, if custom names were used in the model. Would I get both kinds of keys, or just the actual ones (not custom field)?

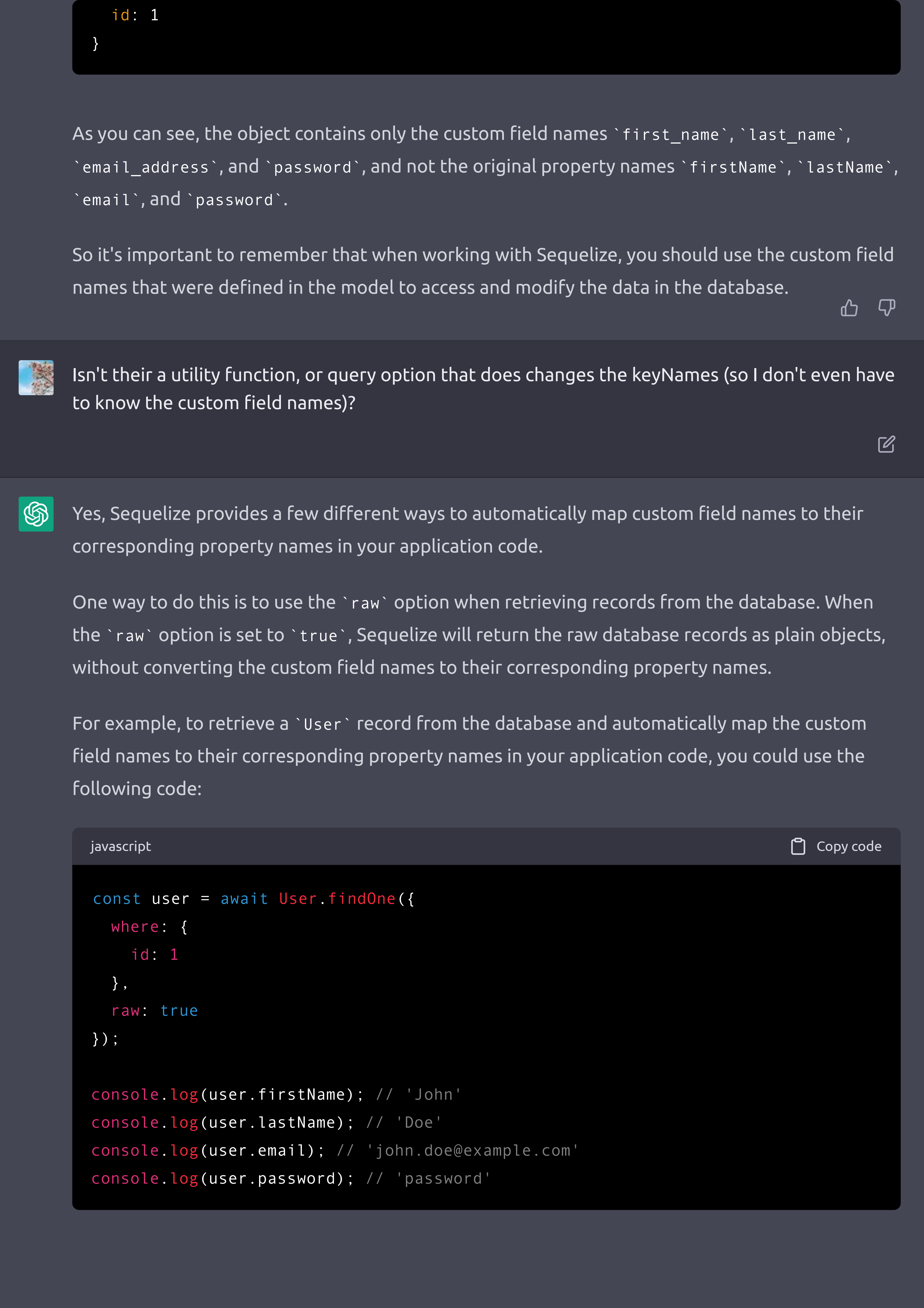
When you retrieve a record (object) from the database using Sequelize, the object will contain only the custom field names that were defined in the model, and not the original property names.

For example, if you retrieve a `User` record using Sequelize after defining custom field names, the resulting object will contain only the custom field names:

```sql
const user = await User.findOne({
  where: {
    id: 1
  }
});

console.log(user);
```

In this example, we retrieve a `User` record from the database using Sequelize's `findOne()` method. The resulting `user` object will contain only the custom field names defined in the model:

```bash
{
  first_name: 'John',
  last_name: 'Doe',
  email_address: 'john.doe@example.com',
  password: 'password',
  createdAt: '2023-04-03T16:07:58.000Z',
  updatedAt: '2023-04-03T16:07:58.000Z',
```



```
  id: 1
}
```

As you can see, the object contains only the custom field names `first_name`, `last_name`, `email_address`, and `password`, and not the original property names `firstName`, `lastName`, `email`, and `password`.

So it's important to remember that when working with Sequelize, you should use the custom field names that were defined in the model to access and modify the data in the database.

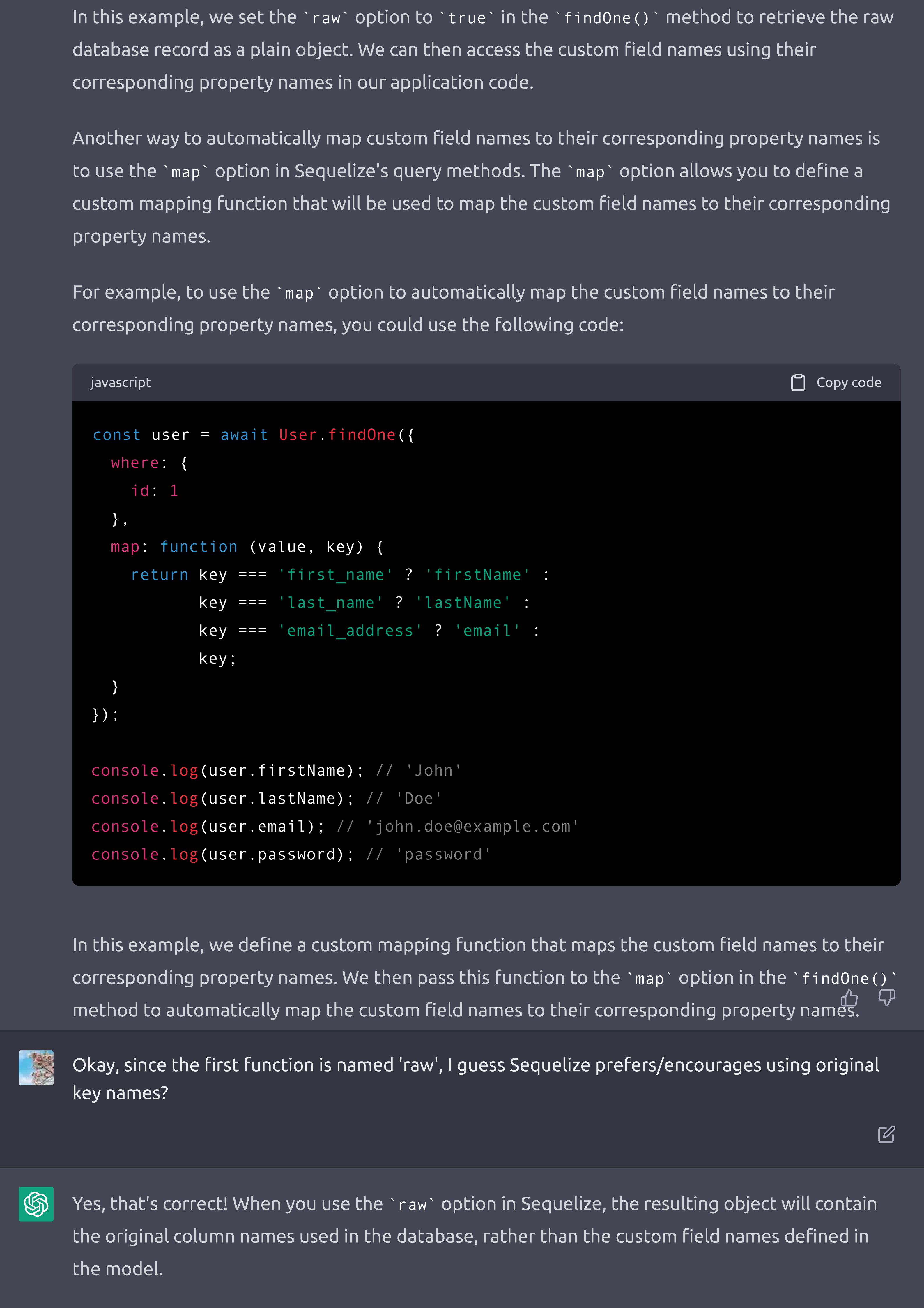
Isn't their a utility function, or query option that does changes the keyNames (so I don't even have to know the custom field names)?

Yes, Sequelize provides a few different ways to automatically map custom field names to their corresponding property names in your application code.

One way to do this is to use the `raw` option when retrieving records from the database. When the `raw` option is set to `true`, Sequelize will return the raw database records as plain objects, without converting the custom field names to their corresponding property names.

For example, to retrieve a `User` record from the database and automatically map the custom field names to their corresponding property names in your application code, you could use the following code:

```javascript
const user = await User.findOne({
  where: {
    id: 1
  },
  raw: true
});

console.log(user.firstName); // 'John'
console.log(user.lastName); // 'Doe'
console.log(user.email); // 'john.doe@example.com'
console.log(user.password); // 'password'
```



In this example, we set the `raw` option to `true` in the `findOne()` method to retrieve the raw database record as a plain object. We can then access the custom field names using their corresponding property names in our application code.

Another way to automatically map custom field names to their corresponding property names is to use the `map` option in Sequelize's query methods. The `map` option allows you to define a custom mapping function that will be used to map the custom field names to their corresponding property names.

For example, to use the `map` option to automatically map the custom field names to their corresponding property names, you could use the following code:

```javascript
const user = await User.findOne({
  where: {
    id: 1
  },
  map: function (value, key) {
    return key === 'first_name' ? 'firstName' :
           key === 'last_name' ? 'lastName' :
           key === 'email_address' ? 'email' :
           key;
  }
});

console.log(user.firstName); // 'John'
console.log(user.lastName); // 'Doe'
console.log(user.email); // 'john.doe@example.com'
console.log(user.password); // 'password'
```

In this example, we define a custom mapping function that maps the custom field names to their corresponding property names. We then pass this function to the `map` option in the `findOne()` method to automatically map the custom field names to their corresponding property names.

Okay, since the first function is named 'raw', I guess Sequelize prefers/encourages using original key names?

Yes, that's correct! When you use the `raw` option in Sequelize, the resulting object will contain the original column names used in the database, rather than the custom field names defined in the model.

Sequelize generally encourages the use of custom field names to map model properties to column names in the database. This can make your application code more readable and maintainable by using property names that are more meaningful and easier to understand.

However, there may be cases where you need to use the original column names in your application code, such as when working with external systems or legacy databases that use specific naming conventions.

In such cases, you can use the `raw` option in Sequelize to retrieve the original column names from the database. But as a general rule, it's best to use custom field names in your model definitions whenever possible to make your code more readable and maintainable.

I didn't get you. By "best to use custom field names", did you mean I should use the snake case ones (in the examples you presented) over the camelcase ones.

Yes, that's correct! In the examples I presented earlier, I showed how you can define custom field names using snake case in your Sequelize model definitions.

When defining custom field names in Sequelize, it's generally a good practice to use a naming convention that is consistent with the database's naming convention. In many databases, the convention is to use snake case (i.e. `first_name`) for column names.

Using a consistent naming convention throughout your codebase can make your code more readable and maintainable, especially when working with larger codebases and teams.

That being said, you could use any naming convention that you prefer, as long as it's consistent throughout your codebase and with the database's naming convention.

Still didn't get it. You mean to say, one should prefer to use the exact same keys in both app, as well as DB, if possible?

Yes, that's correct! Ideally, you should use the exact same keys in both your application code and your database schema whenever possible. This can help to maintain consistency and make your code easier to understand.

When defining a Sequelize model, you can use the `field` option to define custom column names that map to the property names in your model. If you need to use a different naming convention in your database schema, you can use the `field` option to define custom column names that match the database schema.

For example, if your database schema uses snake case naming conventions for column names, you could define your Sequelize models to use snake case naming conventions as well:

```php
const User = sequelize.define('User', {
  first_name: {
    type: DataTypes.STRING,
    allowNull: false
  },
  last_name: {
    type: DataTypes.STRING,
    allowNull: false
  },
  email_address: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false
  }
}, {
  tableName: 'users'
});
```

In this example, we defined a `User` model using snake case naming conventions that match the database schema. We used the `field` option to define custom column names that match the snake case naming convention in the database.

By using a consistent naming convention throughout your codebase and database schema, you can make your code more readable and maintainable.

What are virtual fields? Are they called (in code using parentheses) as functions, or directly used as variables?

Virtual fields in Sequelize are properties on a model that are not persisted in the database, but instead are computed based on the values of other fields in the model or external factors.

Virtual fields can be defined in a Sequelize model using the `virtual` option. When a virtual field is accessed, a getter function is called that computes the value of the field.

Here's an example of how you can define a virtual field in a Sequelize model:

php Copy code

```
const User = sequelize.define('User', {
  firstName: {
    type: DataTypes.STRING,
    allowNull: false
  },
  lastName: {
    type: DataTypes.STRING,
    allowNull: false
  },
  fullName: {
    type: DataTypes.VIRTUAL,
    get() {
      return `${this.firstName} ${this.lastName}`;
    }
  }
});
```

In this example, we defined a `User` model with three fields: `firstName`, `lastName`, and `fullName`. The `fullName` field is defined as a virtual field using the `VIRTUAL` type. We also defined a getter function for the `fullName` field that computes the full name by concatenating the `firstName` and `lastName` fields.

To use the virtual field in your application code, you can access it like a regular property on the model:

csharp Copy code

```
const user = await User.findOne({
  where: {
    id: 1
  }
});
```

```
console.log(user.fullName); // 'John Doe'
```

In this example, we retrieve a `User` record from the database using Sequelize's `findOne()` method. We can then access the `fullName` virtual field on the resulting `user` object like a regular property.

So to answer your question, virtual fields are accessed like regular properties on the model, without using parentheses like a function call. However, a getter function is called internally to compute the value of the virtual field.

Tell me more about the various properties one can specify for a field. You have given examples of type, allowNull.

Sure, here are some other commonly used properties you can specify for a field in a Sequelize model:

- `defaultValue`: Specifies a default value for the field if no value is provided.
- `primaryKey`: Specifies whether the field is a primary key.
- `autoIncrement`: Specifies whether the field should auto-increment on insert.
- `unique`: Specifies whether the field should have a unique constraint.
- `validate`: Specifies one or more validation functions or constraints for the field.
- `references`: Specifies a foreign key constraint for the field.
- `onDelete`: Specifies the action to take when the associated record is deleted (e.g. `CASCADE`, `SET NULL`).
- `onUpdate`: Specifies the action to take when the associated record is updated.

Here's an example of how you can define a field in a Sequelize model with some of these properties:

php Copy code

```php
const User = sequelize.define('User', {
  firstName: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      notEmpty: true,
      len: [2, 50]
    }
  },
  lastName: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      notEmpty: true,
      len: [2, 50]
    }
  },
  email: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true,
    validate: {
      isEmail: true
    }
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      notEmpty: true,
      len: [8, 100]
    }
  }
}, {
  tableName: 'users'
});
```

In this example, we defined a `User` model with four fields: `firstName`, `lastName`, `email`, and `password`. We used the `allowNull` property to specify that all fields are required, and we used the `unique` property to specify that the `email` field should have a unique constraint.

We also used the `validate` property to specify validation functions for each field. The `notEmpty` and `len` validators ensure that each field has a non-empty string value between 2 and 50 characters (for the `firstName` and `lastName` fields) or between 8 and 100 characters (for the `password` field). We also used the `isEmail` validator to ensure that the `email` field has a valid email address format.

By using these properties, you can define a Sequelize model that accurately reflects the schema of your database and includes the necessary constraints and validations for your application.

How can I write custom validation for a field, i.e. as a function?

You can define custom validation functions for a field in a Sequelize model using the `validate` property. The `validate` property can be set to an object with one or more validation methods or constraints, or it can be set to a validation function that takes a value and returns a Promise that resolves if the value is valid or rejects with an error message if the value is invalid.

Here's an example of how you can define a custom validation function for a field in a Sequelize model:

php Copy code

```
const User = sequelize.define('User', {
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      notEmpty: true,
      isUnique: async function (value) {
        const user = await User.findOne({ where: { username: value } });
        if (user) {
          throw new Error('Username is already in use');
        }
      }
    }
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      notEmpty: true,
      len: [8, 100]
    }
  }
});
```

In this example, we defined a `User` model with two fields: `username` and `password`. We used the `validate` property to define two validation functions for the `username` field: `notEmpty` and `isUnique`.

The `isUnique` validation function is defined as an asynchronous function that takes a value and checks if there is another record in the database with the same username. If there is, the function throws an error with a message indicating that the username is already in use.

You can define custom validation functions for any field in your Sequelize models, and use them to enforce any custom validation rules that are not covered by the built-in validators.

Oh, so each validate key is either some values, which Sequelize knows how to validate, i.e. for length, it'll do field.length is within that values.

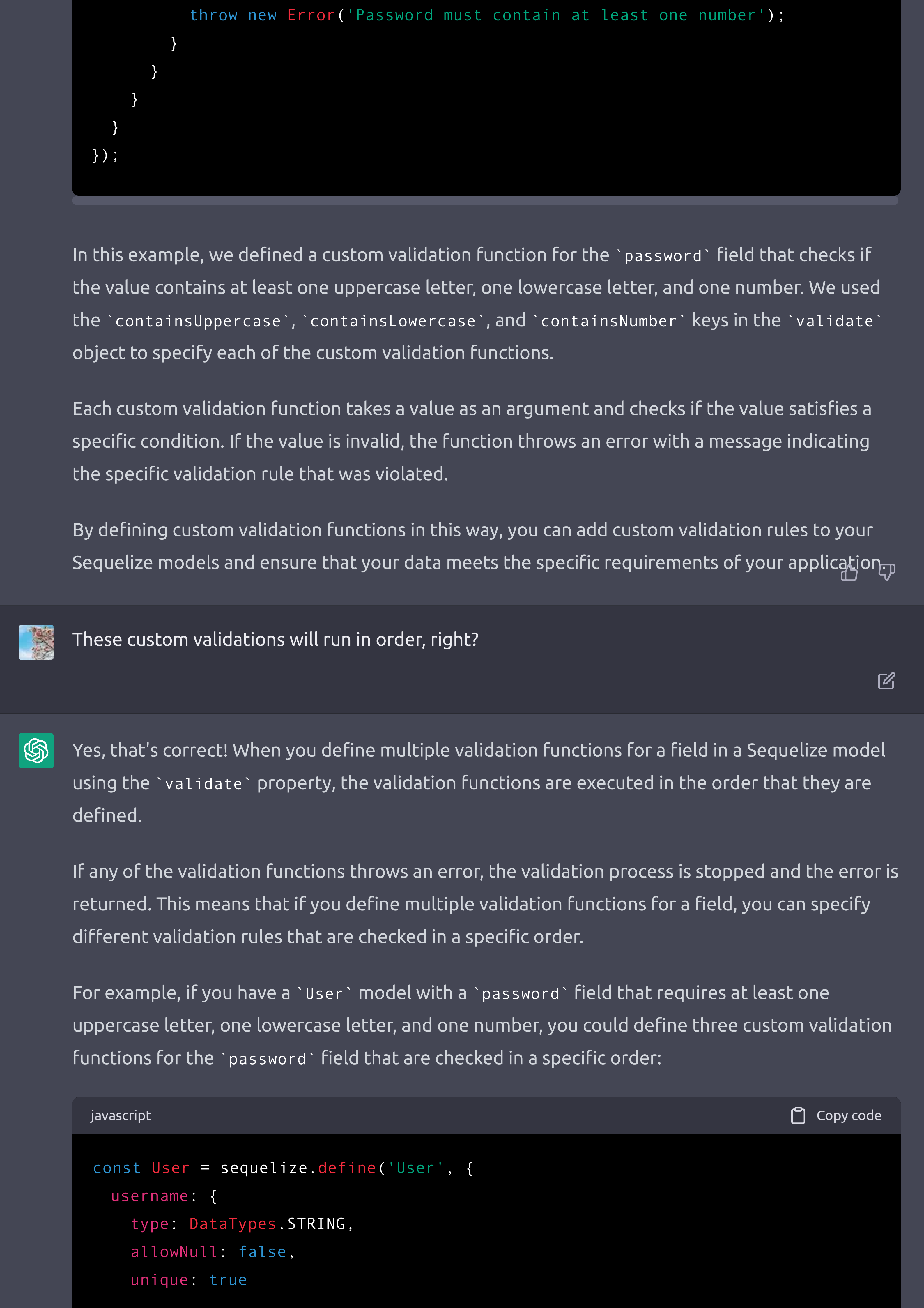
But for custom ones, I can provide a function, instead of a value. And the function should return a boolean, right?

Yes, that's correct! When you use the `validate` property to define validation rules for a field in a Sequelize model, you can specify either a built-in validation rule (such as `notEmpty`, `len`, or `isEmail`), or a custom validation function that takes a value and returns either `true` (if the value is valid) or an error message (if the value is invalid).

For example, to define a custom validation function that checks if a password contains at least one uppercase letter, one lowercase letter, and one number, you could write something like this:

javascript

```javascript
const User = sequelize.define('User', {
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      containsUppercase: function(value) {
        if (!/[A-Z]/.test(value)) {
          throw new Error('Password must contain at least one uppercase letter');
        }
      },
      containsLowercase: function(value) {
        if (!/[a-z]/.test(value)) {
          throw new Error('Password must contain at least one lowercase letter');
        }
      },
      containsNumber: function(value) {
        if (!/\d/.test(value)) {
```



```
          throw new Error('Password must contain at least one number');
        }
      }
    }
  }
});
```

In this example, we defined a custom validation function for the `password` field that checks if the value contains at least one uppercase letter, one lowercase letter, and one number. We used the `containsUppercase`, `containsLowercase`, and `containsNumber` keys in the `validate` object to specify each of the custom validation functions.

Each custom validation function takes a value as an argument and checks if the value satisfies a specific condition. If the value is invalid, the function throws an error with a message indicating the specific validation rule that was violated.

By defining custom validation functions in this way, you can add custom validation rules to your Sequelize models and ensure that your data meets the specific requirements of your application.

These custom validations will run in order, right?

Yes, that's correct! When you define multiple validation functions for a field in a Sequelize model using the `validate` property, the validation functions are executed in the order that they are defined.

If any of the validation functions throws an error, the validation process is stopped and the error is returned. This means that if you define multiple validation functions for a field, you can specify different validation rules that are checked in a specific order.

For example, if you have a `User` model with a `password` field that requires at least one uppercase letter, one lowercase letter, and one number, you could define three custom validation functions for the `password` field that are checked in a specific order:

```javascript
const User = sequelize.define('User', {
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true
```

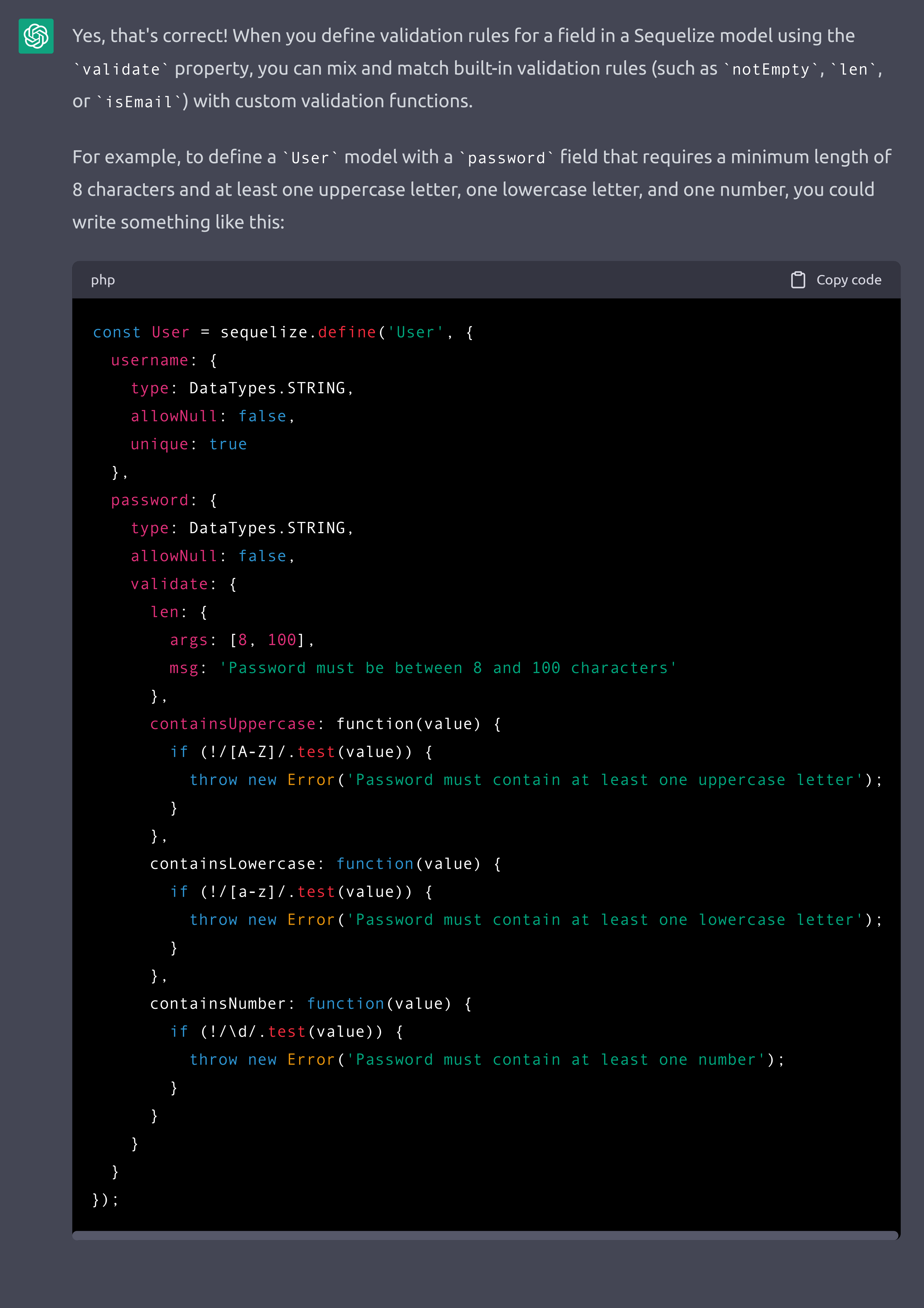
```
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      containsUppercase: function(value) {
        if (!/[A-Z]/.test(value)) {
          throw new Error('Password must contain at least one uppercase letter');
        }
      },
      containsLowercase: function(value) {
        if (!/[a-z]/.test(value)) {
          throw new Error('Password must contain at least one lowercase letter');
        }
      },
      containsNumber: function(value) {
        if (!/\d/.test(value)) {
          throw new Error('Password must contain at least one number');
        }
      }
    }
  }
});
```

In this example, we defined three custom validation functions for the `password` field: `containsUppercase`, `containsLowercase`, and `containsNumber`. These validation functions are executed in the order that they are defined.

If the `containsUppercase` function returns `false` (indicating that the password does not contain an uppercase letter), the validation process stops and an error is thrown with the message 'Password must contain at least one uppercase letter'. Similarly, if the `containsLowercase` function or the `containsNumber` function returns `false`, the validation process stops and an error is thrown with the appropriate message.

By defining validation functions in a specific order like this, you can enforce specific validation rules and provide specific error messages to the user when the data is invalid.

I can interleave in-build validations with custom validations, rigjht?



Yes, that's correct! When you define validation rules for a field in a Sequelize model using the `validate` property, you can mix and match built-in validation rules (such as `notEmpty`, `len`, or `isEmail`) with custom validation functions.

For example, to define a `User` model with a `password` field that requires a minimum length of 8 characters and at least one uppercase letter, one lowercase letter, and one number, you could write something like this:

```php
const User = sequelize.define('User', {
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      len: {
        args: [8, 100],
        msg: 'Password must be between 8 and 100 characters'
      },
      containsUppercase: function(value) {
        if (!/[A-Z]/.test(value)) {
          throw new Error('Password must contain at least one uppercase letter');
        }
      },
      containsLowercase: function(value) {
        if (!/[a-z]/.test(value)) {
          throw new Error('Password must contain at least one lowercase letter');
        }
      },
      containsNumber: function(value) {
        if (!/\d/.test(value)) {
          throw new Error('Password must contain at least one number');
        }
      }
    }
  }
});
```

In this example, we defined four validation rules for the `password` field: a `len` validator that checks the length of the password, and three custom validation functions that check if the password contains an uppercase letter, a lowercase letter, and a number.

Each validation rule is specified as a key-value pair in the `validate` object. The `len` validator is defined using an object with an `args` property that specifies the minimum and maximum length of the password, and a `msg` property that specifies the error message to be displayed if the password length is invalid.

The custom validation functions are defined as separate functions that take the password value as an argument and check if the value satisfies a specific condition. If the value is invalid, the function throws an error with a message indicating the specific validation rule that was violated.

By mixing and matching built-in and custom validation rules like this, you can define validation rules that accurately reflect the specific requirements of your application, and provide specific error messages to the user when the data is invalid.

And if the validation is async, Sequelize will call is properly (i.e. wait for it), right?

Yes, that's correct! If you define an asynchronous validation function for a field in a Sequelize model, Sequelize will correctly handle the asynchronous nature of the function and wait for it to complete before moving on to the next validation rule.

For example, if you have a custom validation function that needs to make an asynchronous call to an external API to validate a field value, you can define an asynchronous validation function like this:

php Copy code

```php
const User = sequelize.define('User', {
  email: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      isEmail: true,
      isUnique: async function(value) {
        const user = await User.findOne({ where: { email: value } });
        if (user) {
          throw new Error('Email is already in use');
        }
      }
    }
  }
});
```

In this example, we defined a `User` model with an `email` field that has two validation rules: `isEmail` and `isUnique`. The `isEmail` rule is a built-in validator that checks if the value is a valid email address.

The `isUnique` rule is a custom validation function that makes an asynchronous call to the database to check if the email address is already in use by another user. The function uses the `async` keyword to indicate that it is an asynchronous function, and uses the `await` keyword to wait for the `User.findOne` query to complete before checking the result.

If the query returns a user object, indicating that the email address is already in use, the function throws an error with a message indicating that the email address is already in use. Because the `isUnique` validation function is asynchronous, Sequelize will correctly wait for the function to complete before moving on to the next validation rule.

Okay, this linear custom validations are fine. What if I have two validation suites, and it's OK if either (or both) pass. How should I code that?

If you have two or more sets of validation rules for a field in a Sequelize model, and you want to check if either (or both) sets of rules pass, you can use the `or` method of the Sequelize validation library to combine the sets of rules.

For example, if you have a `User` model with a `username` field that should be unique, and a `password` field that should have a minimum length of 8 characters or contain at least one special character, you could write something like this:

php

Copy code

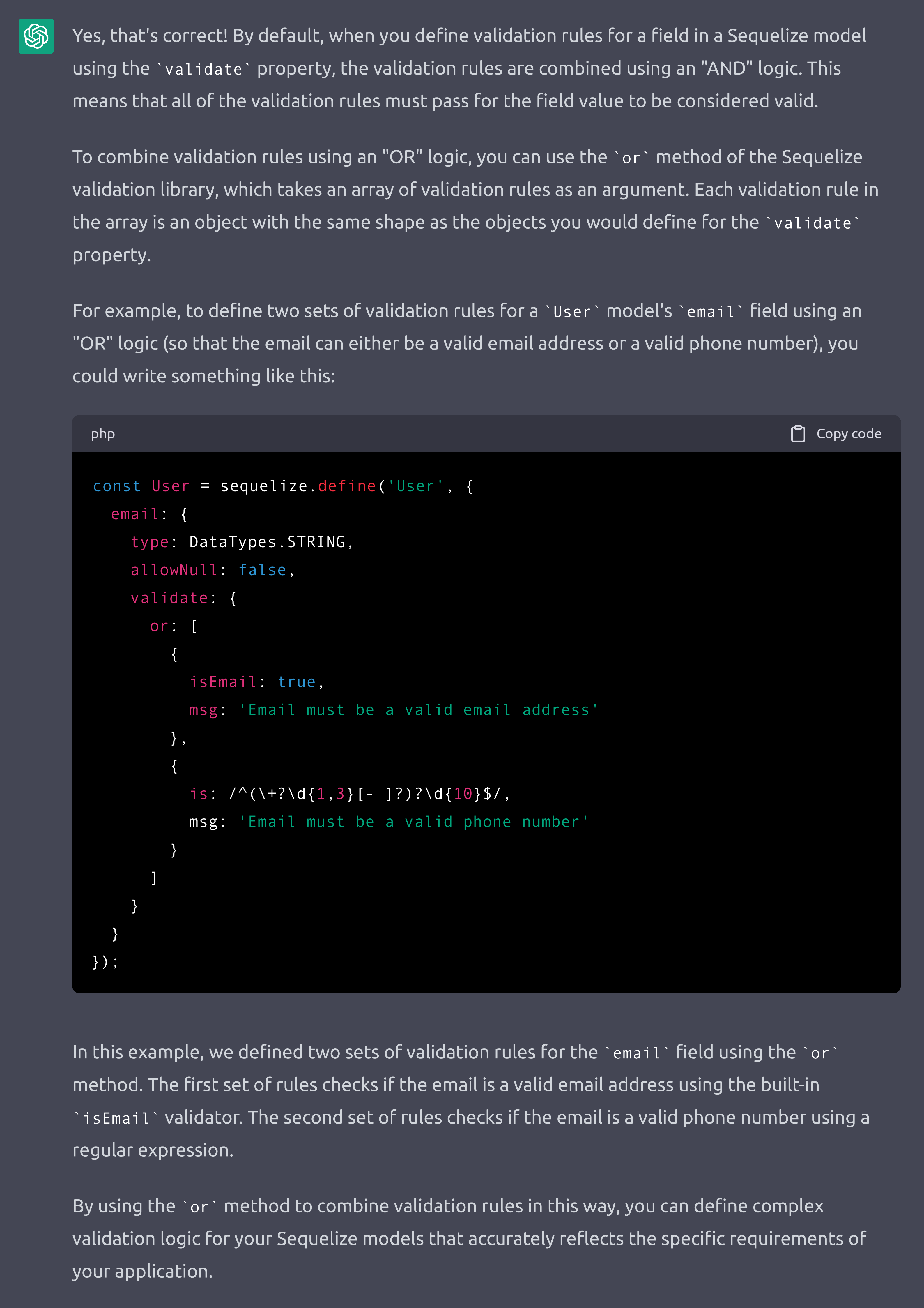
```php
const User = sequelize.define('User', {
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true,
    validate: {
      notEmpty: true
    }
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      or: [
        {
          len: {
            args: [8, 100],
            msg: 'Password must be between 8 and 100 characters'
          }
        },
        {
          contains: {
            args: ['!', '@', '#', '$', '%', '^', '&', '*', '(', ')'],
            msg: 'Password must contain at least one special character (!, @, #, $,
          }
        }
      ]
    }
  }
});
```

In this example, we defined two sets of validation rules for the `password` field using the `or` method of the Sequelize validation library. The first set of rules requires the password to have a minimum length of 8 characters, and the second set of rules requires the password to contain at least one special character.

The `or` method takes an array of validation rules as an argument, and checks if any of the rules pass. If any of the rules pass, the validation is considered successful. In this example, if the password is either 8 characters or longer, or contains at least one of the special characters `!`, `@`, `#`, `$`, `%`, `^`, `&`, `*`, `(`, or `)`, the validation is considered successful.

By using the `or` method to combine sets of validation rules like this, you can define complex validation rules for your Sequelize models that accurately reflect the specific requirements of your application.

OK. So the default is AND. And for OR, I pass an array with valiate objects, just like (same shape) I would for AND.



Yes, that's correct! By default, when you define validation rules for a field in a Sequelize model using the `validate` property, the validation rules are combined using an "AND" logic. This means that all of the validation rules must pass for the field value to be considered valid.

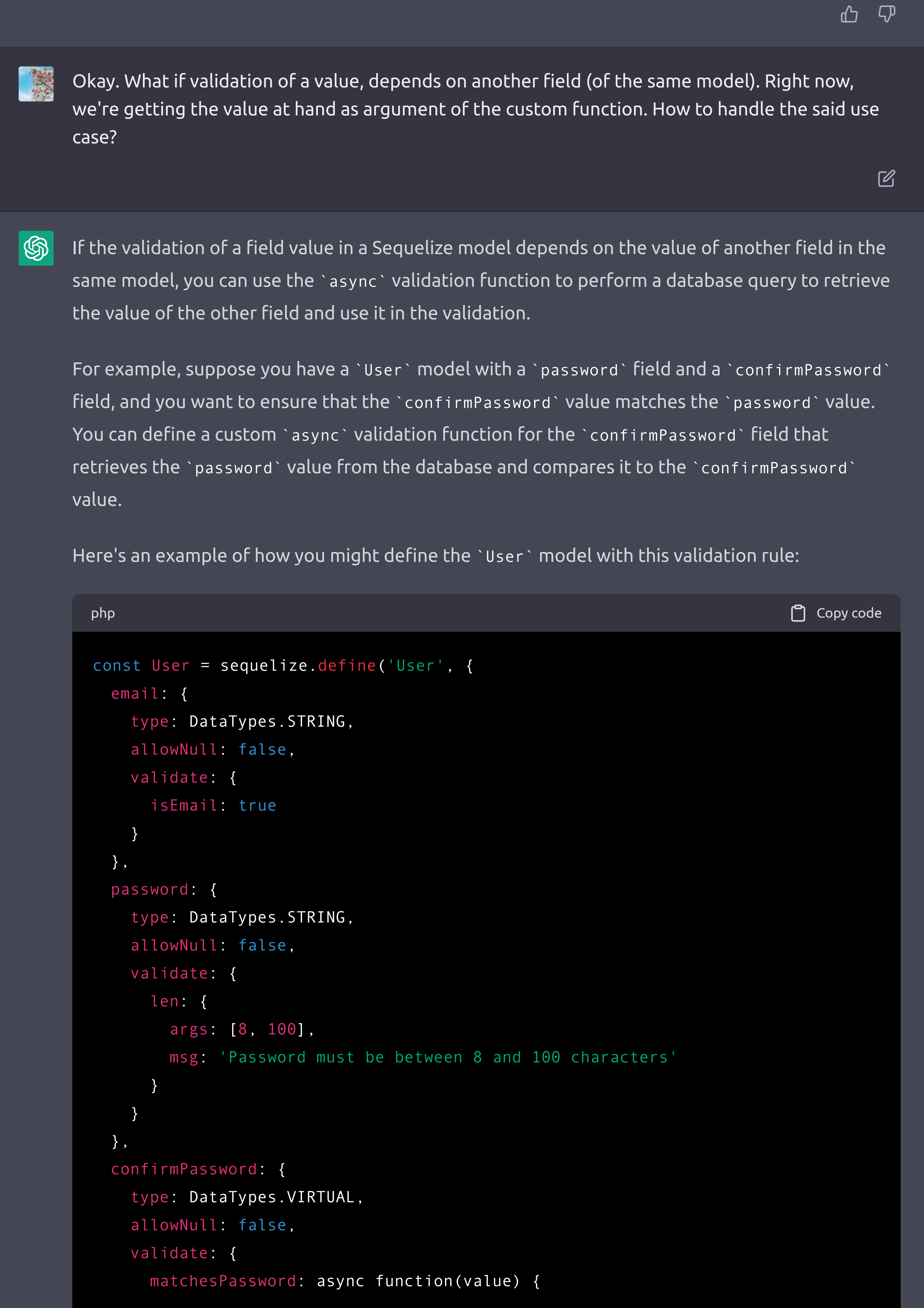
To combine validation rules using an "OR" logic, you can use the `or` method of the Sequelize validation library, which takes an array of validation rules as an argument. Each validation rule in the array is an object with the same shape as the objects you would define for the `validate` property.

For example, to define two sets of validation rules for a `User` model's `email` field using an "OR" logic (so that the email can either be a valid email address or a valid phone number), you could write something like this:

```php
const User = sequelize.define('User', {
  email: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      or: [
        {
          isEmail: true,
          msg: 'Email must be a valid email address'
        },
        {
          is: /^(\+?\d{1,3}[- ]?)?\d{10}$/,
          msg: 'Email must be a valid phone number'
        }
      ]
    }
  }
});
```

In this example, we defined two sets of validation rules for the `email` field using the `or` method. The first set of rules checks if the email is a valid email address using the built-in `isEmail` validator. The second set of rules checks if the email is a valid phone number using a regular expression.

By using the `or` method to combine validation rules in this way, you can define complex validation logic for your Sequelize models that accurately reflects the specific requirements of your application.



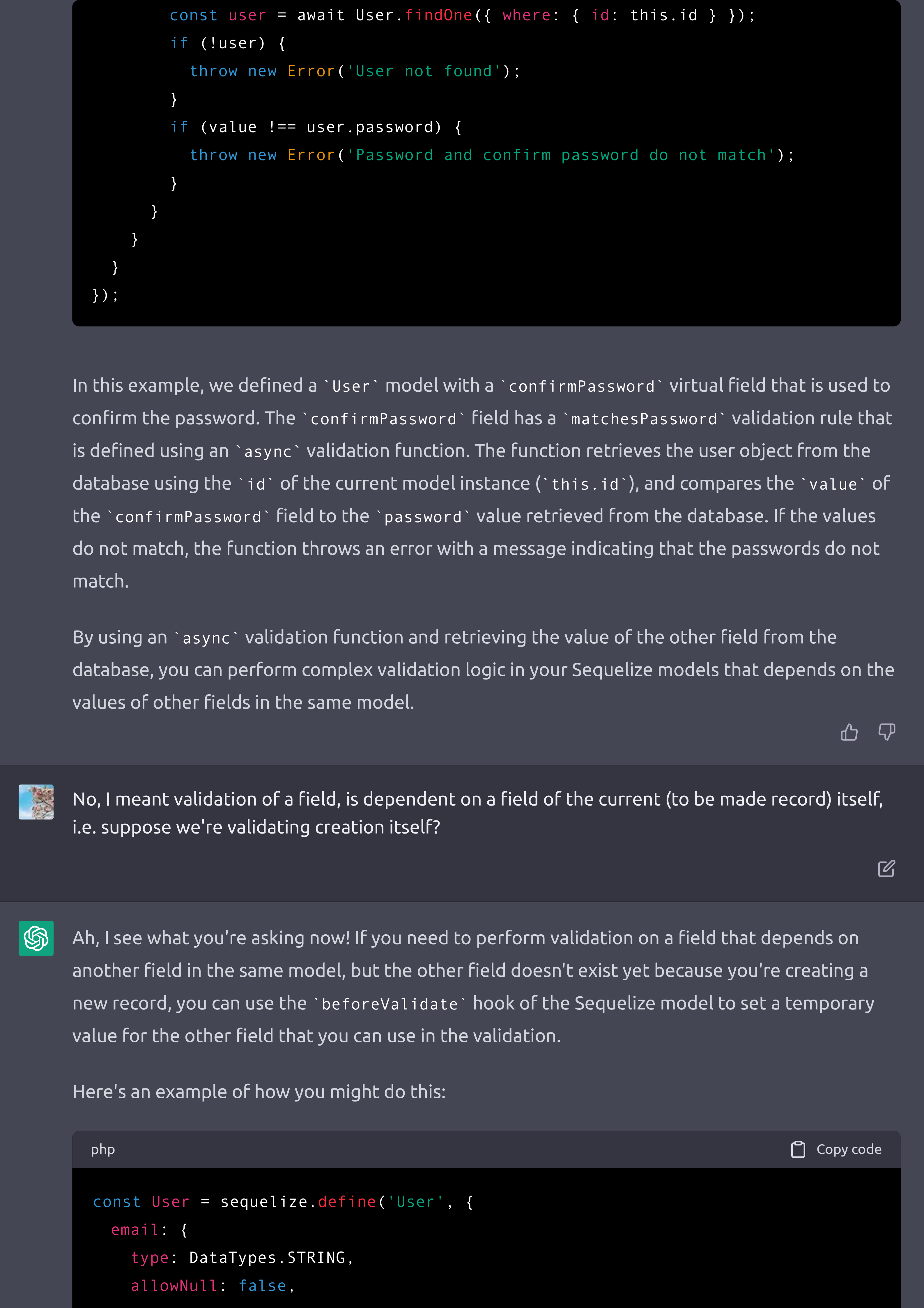
Okay. What if validation of a value, depends on another field (of the same model). Right now, we're getting the value at hand as argument of the custom function. How to handle the said use case?

If the validation of a field value in a Sequelize model depends on the value of another field in the same model, you can use the `async` validation function to perform a database query to retrieve the value of the other field and use it in the validation.

For example, suppose you have a `User` model with a `password` field and a `confirmPassword` field, and you want to ensure that the `confirmPassword` value matches the `password` value. You can define a custom `async` validation function for the `confirmPassword` field that retrieves the `password` value from the database and compares it to the `confirmPassword` value.

Here's an example of how you might define the `User` model with this validation rule:

```php
const User = sequelize.define('User', {
  email: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      isEmail: true
    }
  },
  password: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      len: {
        args: [8, 100],
        msg: 'Password must be between 8 and 100 characters'
      }
    }
  },
  confirmPassword: {
    type: DataTypes.VIRTUAL,
    allowNull: false,
    validate: {
      matchesPassword: async function(value) {
```



```
        const user = await User.findOne({ where: { id: this.id } });
        if (!user) {
          throw new Error('User not found');
        }
        if (value !== user.password) {
          throw new Error('Password and confirm password do not match');
        }
      }
    }
  }
});
```

In this example, we defined a `User` model with a `confirmPassword` virtual field that is used to confirm the password. The `confirmPassword` field has a `matchesPassword` validation rule that is defined using an `async` validation function. The function retrieves the user object from the database using the `id` of the current model instance (`this.id`), and compares the `value` of the `confirmPassword` field to the `password` value retrieved from the database. If the values do not match, the function throws an error with a message indicating that the passwords do not match.

By using an `async` validation function and retrieving the value of the other field from the database, you can perform complex validation logic in your Sequelize models that depends on the values of other fields in the same model.

No, I meant validation of a field, is dependent on a field of the current (to be made record) itself, i.e. suppose we're validating creation itself?

Ah, I see what you're asking now! If you need to perform validation on a field that depends on another field in the same model, but the other field doesn't exist yet because you're creating a new record, you can use the `beforeValidate` hook of the Sequelize model to set a temporary value for the other field that you can use in the validation.

Here's an example of how you might do this:

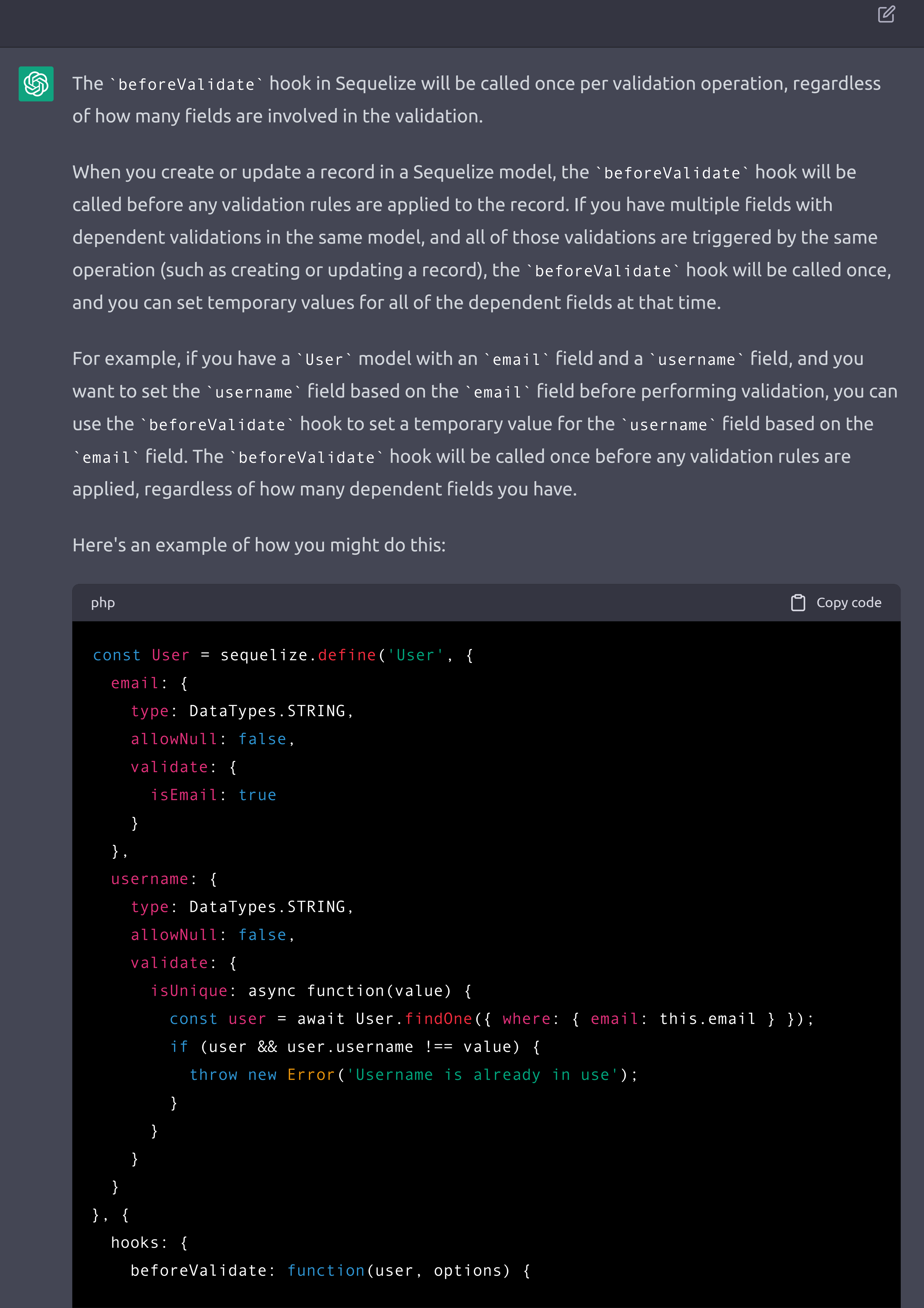
```
const User = sequelize.define('User', {
  email: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      isEmail: true
    }
  },
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      isUnique: async function(value) {
        const user = await User.findOne({ where: { email: this.email } });
        if (user && user.username !== value) {
          throw new Error('Username is already in use');
        }
      }
    }
  }
}, {
  hooks: {
    beforeValidate: function(user, options) {
      if (user.email) {
        user.username = user.email.split('@')[0];
      }
    }
  }
});
```

In this example, we defined a `User` model with an `email` field and a `username` field. The `username` field has a custom validation rule called `isUnique` that checks if the username is already in use by another user with the same email address. The `isUnique` validation function uses the `this.email` property to retrieve the email address of the user being validated.

Because the `email` field may not exist yet when the validation function is called (if you're creating a new record), we use the `beforeValidate` hook to set a temporary value for the `username` field based on the `email` field. In this example, we set the `username` field to the part of the email address before the `@` symbol.

By setting a temporary value for the `username` field in the `beforeValidate` hook, we can perform validation logic that depends on the value of another field in the same model, even if that field doesn't exist yet because we're creating a new record.

How many time would 'beforeValidate' run, assuming two fields had dependent validations, on fields of the same model?



The `beforeValidate` hook in Sequelize will be called once per validation operation, regardless of how many fields are involved in the validation.

When you create or update a record in a Sequelize model, the `beforeValidate` hook will be called before any validation rules are applied to the record. If you have multiple fields with dependent validations in the same model, and all of those validations are triggered by the same operation (such as creating or updating a record), the `beforeValidate` hook will be called once, and you can set temporary values for all of the dependent fields at that time.

For example, if you have a `User` model with an `email` field and a `username` field, and you want to set the `username` field based on the `email` field before performing validation, you can use the `beforeValidate` hook to set a temporary value for the `username` field based on the `email` field. The `beforeValidate` hook will be called once before any validation rules are applied, regardless of how many dependent fields you have.

Here's an example of how you might do this:

```php
const User = sequelize.define('User', {
  email: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      isEmail: true
    }
  },
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    validate: {
      isUnique: async function(value) {
        const user = await User.findOne({ where: { email: this.email } });
        if (user && user.username !== value) {
          throw new Error('Username is already in use');
        }
      }
    }
  }
}, {
  hooks: {
    beforeValidate: function(user, options) {
      if (user.email && !user.username) {
        user.username = user.email.split('@')[0];
      }
    }
  }
});
```

In this example, we defined a `User` model with an `email` field and a `username` field. The `username` field is dependent on the `email` field, because we want to set the username based on the email address before performing validation. We use the `beforeValidate` hook to set a temporary value for the `username` field if it doesn't already have a value. The `beforeValidate` hook will be called once before performing any validation rules, regardless of how many dependent fields you have in the model.

Okay, this was validations. What is the term when some operating needs to run on every creation? Where would I write that code, in the model?

The term you are looking for is "hooks". Hooks in Sequelize are functions that allow you to add custom code to be executed before or after certain operations on a Sequelize model. For example, you can use hooks to execute custom code before or after creating, updating, or deleting records in the database.

There are several different types of hooks in Sequelize, each of which is associated with a specific type of operation on a model. The most commonly used hooks are the `beforeCreate`, `afterCreate`, `beforeUpdate`, and `afterUpdate` hooks, which are called before or after a record is created or updated in the database.

To define a hook in a Sequelize model, you can use the `hooks` property of the model definition object. For example, to define a `beforeCreate` hook that sets a default value for a field before creating a record, you can write something like this:

javascript Copy code

```javascript
const User = sequelize.define('User', {
  firstName: DataTypes.STRING,
  lastName: DataTypes.STRING,
  fullName: {
    type: DataTypes.VIRTUAL,
    get() {
      return `${this.firstName} ${this.lastName}`;
      }
    }
}, {
  hooks: {
    beforeCreate: (user, options) => {
      if (!user.firstName && !user.lastName) {
        user.fullName = 'John Doe';
      }
    }
  }
});
```

In this example, we defined a `User` model with `firstName`, `lastName`, and `fullName` fields. The `fullName` field is a virtual field that is derived from the `firstName` and `lastName` fields using a getter function.

We defined a `beforeCreate` hook that sets a default value for the `fullName` field if the `firstName` and `lastName` fields are not set. The hook function is called with two arguments: the `user` object, which contains the data for the record being created, and an `options` object that contains additional options for the operation.

By defining a hook in this way, you can execute custom code before or after any operation on a Sequelize model, allowing you to implement custom logic for your application's needs.

You wrote the following code in an example:

```js
confirmPassword: {
  type: DataTypes.VIRTUAL,
  allowNull: false,
  validate: {
   matchesPassword: async function(value) {
    const user = await User.findOne({ where: { id: this.id } });
    if (!user) {
     throw new Error('User not found');
    }
    if (value !== user.password) {
     throw new Error('Password and confirm password do not match');
    }
   }
  }
 }
```

Not providing a `get` will raise an error here, right?

Yes, you are correct. Defining a virtual field without a `get` function will result in a Sequelize `TypeError` when you try to use the field.

When you define a virtual field in Sequelize, you must provide a `get` function that returns the computed value for the field. The `get` function is called when you access the virtual field as a property of a model instance, and it should return the computed value for the field based on other fields in the model.

In the example code you provided, the `confirmPassword` field is defined as a virtual field, but it doesn't have a `get` function. If you try to use the `confirmPassword` field in a query or access it as a property of a model instance, you will get a Sequelize `TypeError`.

To fix this, you can define a `get` function for the `confirmPassword` field that returns the value of the field. Here's an example of how you might do this:

```javascript
confirmPassword: {
  type: DataTypes.VIRTUAL,
  allowNull: false,
  get() {
    return this.getDataValue('confirmPassword');
  },
  validate: {
    matchesPassword: async function(value) {
      const user = await User.findOne({ where: { id: this.id } });
      if (!user) {
        throw new Error('User not found');
      }
      if (value !== user.password) {
        throw new Error('Password and confirm password do not match');
      }
    }
  }
}
```

In this example, we added a `get` function to the `confirmPassword` field that returns the value of the field using the `getDataValue` method. This will allow you to use the `confirmPassword` field in queries and access it as a property of a model instance without getting a Sequelize `TypeError`.

Okay, so that was just a mistake from your side?

Yes, that was a mistake on my part. I apologize for the confusion. When defining a virtual field in Sequelize, it is necessary to provide a `get` function that returns the computed value for the field. Without a `get` function, you will get a Sequelize `TypeError` when trying to use the field.

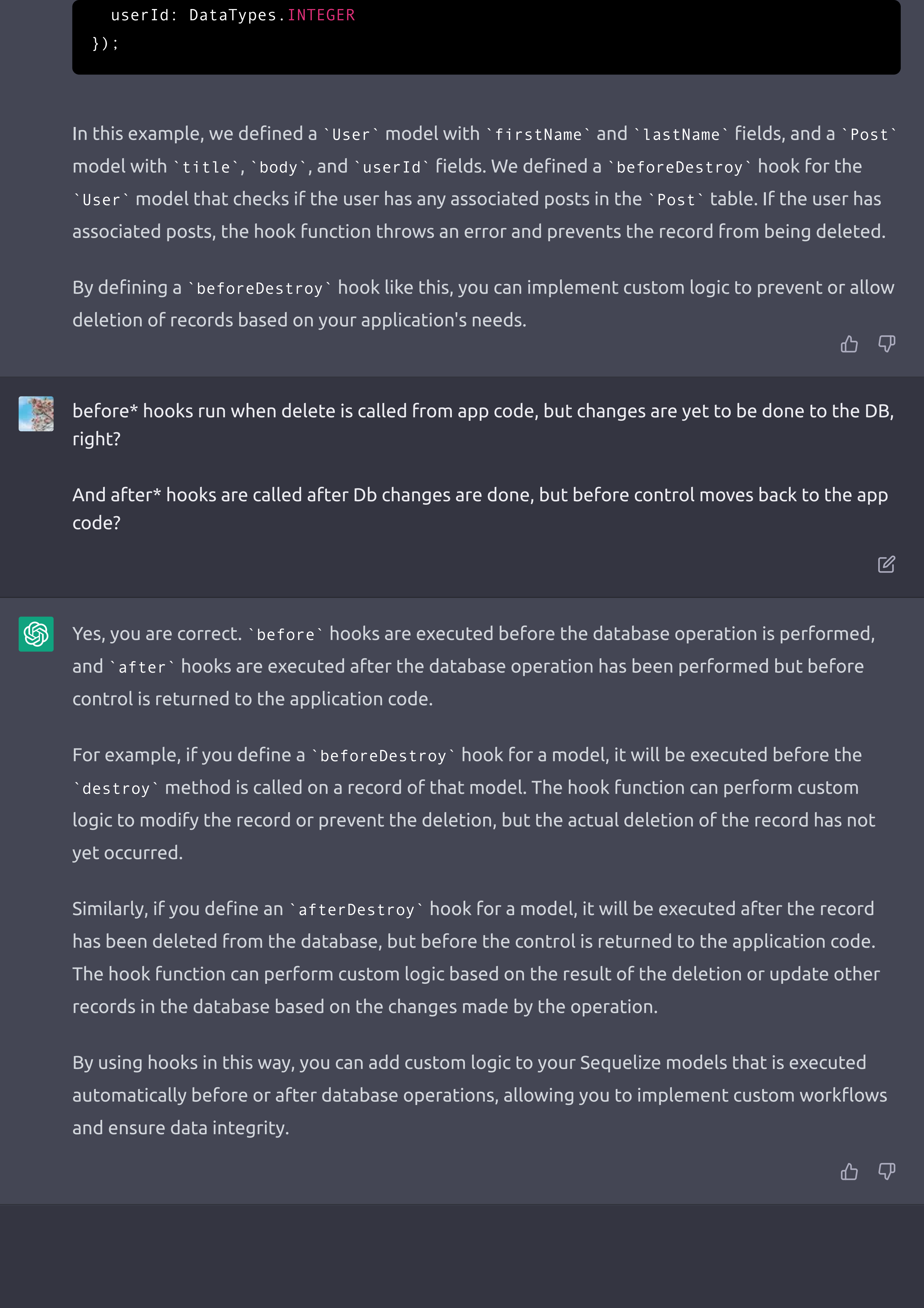
Aren't there deletion hooks?

Yes, Sequelize provides hooks for deletion operations as well. The most commonly used hooks for deletion are the `beforeDestroy` and `afterDestroy` hooks, which are called before and after a record is deleted from the database.

To define a `beforeDestroy` or `afterDestroy` hook for a model in Sequelize, you can use the `hooks` property of the model definition object, just like with other hooks. For example, to define a `beforeDestroy` hook that prevents a record from being deleted if it has associated records in another table, you can write something like this:

vbnet Copy code

```
const User = sequelize.define('User', {
  firstName: DataTypes.STRING,
  lastName: DataTypes.STRING
}, {
  hooks: {
    beforeDestroy: async (user, options) => {
      const hasPosts = await Post.findOne({ where: { userId: user.id } });
      if (hasPosts) {
        throw new Error('Cannot delete user with associated posts');
      }
    }
  }
});

const Post = sequelize.define('Post', {
  title: DataTypes.STRING,
  body: DataTypes.TEXT,
```



```
  userId: DataTypes.INTEGER
});
```

In this example, we defined a `User` model with `firstName` and `lastName` fields, and a `Post` model with `title`, `body`, and `userId` fields. We defined a `beforeDestroy` hook for the `User` model that checks if the user has any associated posts in the `Post` table. If the user has associated posts, the hook function throws an error and prevents the record from being deleted.

By defining a `beforeDestroy` hook like this, you can implement custom logic to prevent or allow deletion of records based on your application's needs.

before* hooks run when delete is called from app code, but changes are yet to be done to the DB, right?

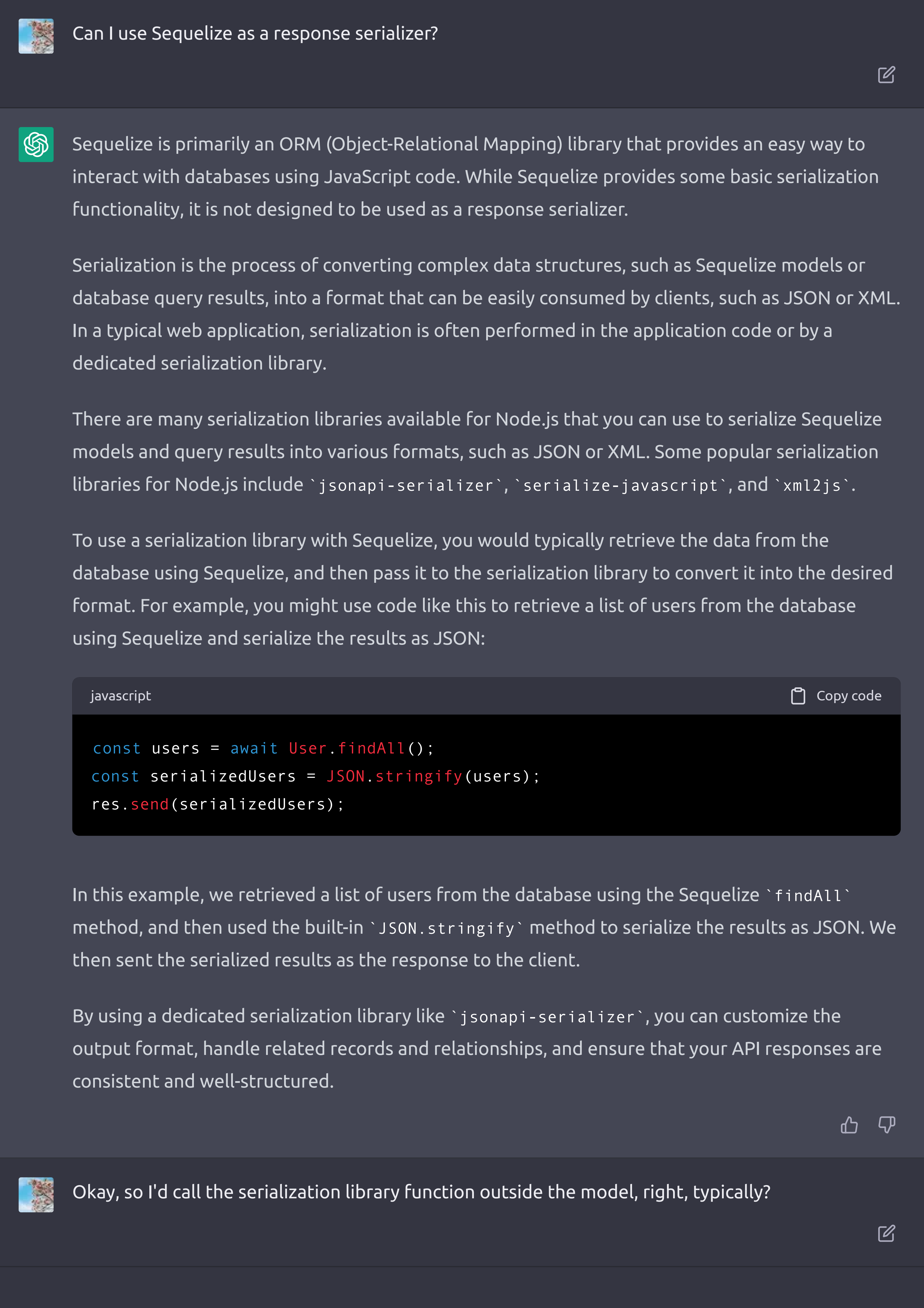
And after* hooks are called after Db changes are done, but before control moves back to the app code?

Yes, you are correct. `before` hooks are executed before the database operation is performed, and `after` hooks are executed after the database operation has been performed but before control is returned to the application code.

For example, if you define a `beforeDestroy` hook for a model, it will be executed before the `destroy` method is called on a record of that model. The hook function can perform custom logic to modify the record or prevent the deletion, but the actual deletion of the record has not yet occurred.

Similarly, if you define an `afterDestroy` hook for a model, it will be executed after the record has been deleted from the database, but before the control is returned to the application code. The hook function can perform custom logic based on the result of the deletion or update other records in the database based on the changes made by the operation.

By using hooks in this way, you can add custom logic to your Sequelize models that is executed automatically before or after database operations, allowing you to implement custom workflows and ensure data integrity.



Can I use Sequelize as a response serializer?

Sequelize is primarily an ORM (Object-Relational Mapping) library that provides an easy way to interact with databases using JavaScript code. While Sequelize provides some basic serialization functionality, it is not designed to be used as a response serializer.

Serialization is the process of converting complex data structures, such as Sequelize models or database query results, into a format that can be easily consumed by clients, such as JSON or XML. In a typical web application, serialization is often performed in the application code or by a dedicated serialization library.

There are many serialization libraries available for Node.js that you can use to serialize Sequelize models and query results into various formats, such as JSON or XML. Some popular serialization libraries for Node.js include `jsonapi-serializer`, `serialize-javascript`, and `xml2js`.

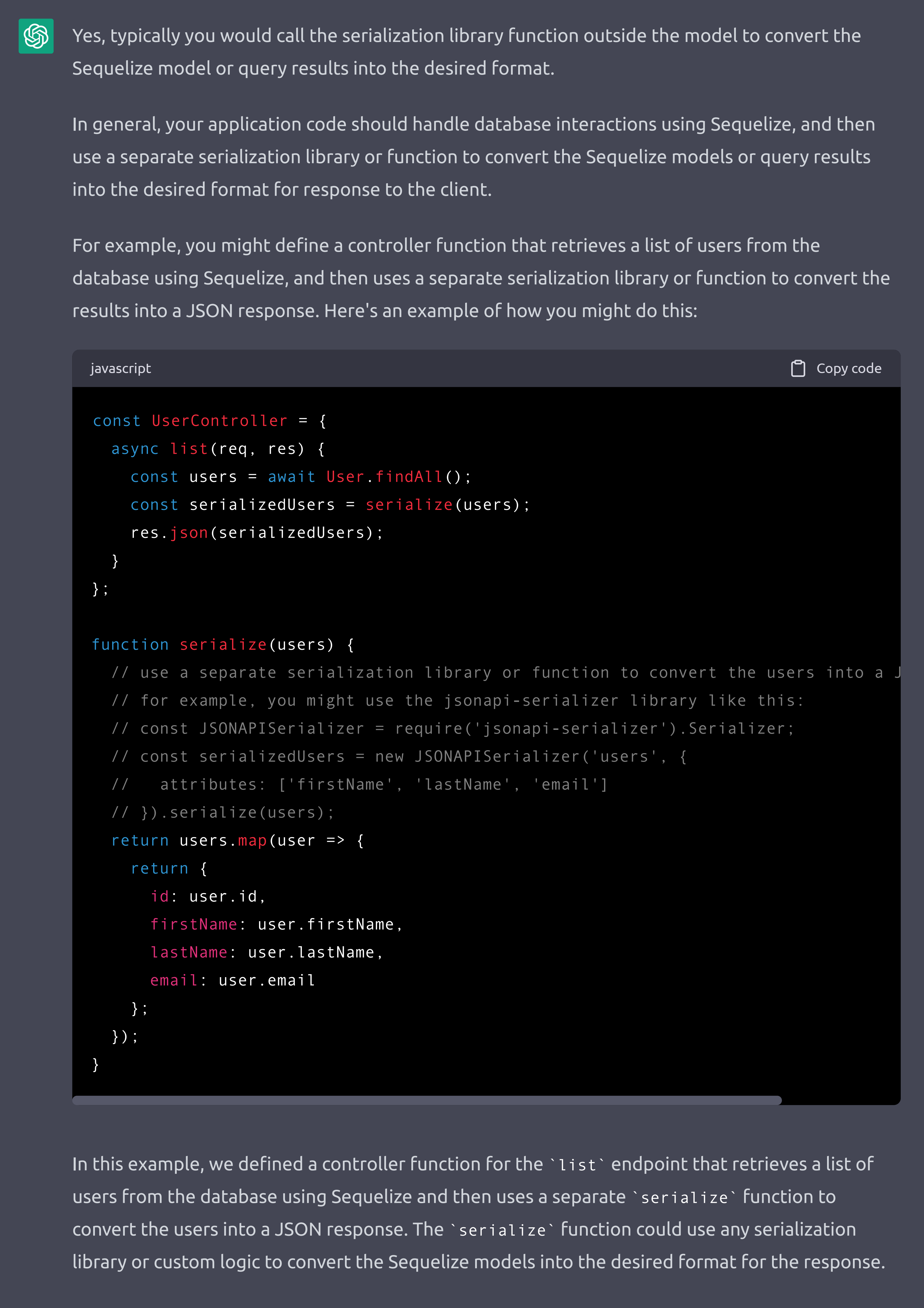
To use a serialization library with Sequelize, you would typically retrieve the data from the database using Sequelize, and then pass it to the serialization library to convert it into the desired format. For example, you might use code like this to retrieve a list of users from the database using Sequelize and serialize the results as JSON:

```javascript
const users = await User.findAll();
const serializedUsers = JSON.stringify(users);
res.send(serializedUsers);
```

In this example, we retrieved a list of users from the database using the Sequelize `findAll` method, and then used the built-in `JSON.stringify` method to serialize the results as JSON. We then sent the serialized results as the response to the client.

By using a dedicated serialization library like `jsonapi-serializer`, you can customize the output format, handle related records and relationships, and ensure that your API responses are consistent and well-structured.

Okay, so I'd call the serialization library function outside the model, right, typically?



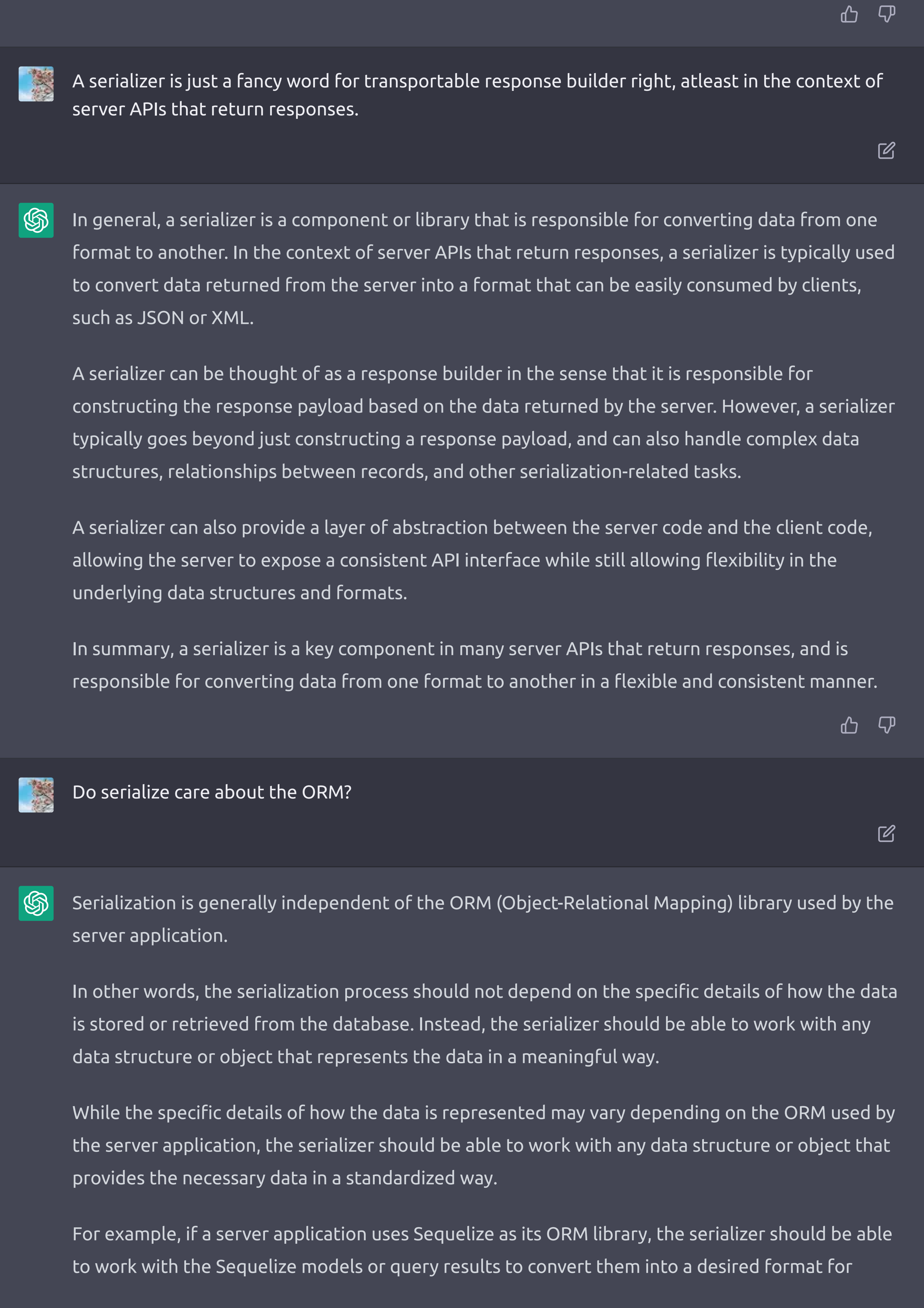
Yes, typically you would call the serialization library function outside the model to convert the Sequelize model or query results into the desired format.

In general, your application code should handle database interactions using Sequelize, and then use a separate serialization library or function to convert the Sequelize models or query results into the desired format for response to the client.

For example, you might define a controller function that retrieves a list of users from the database using Sequelize, and then uses a separate serialization library or function to convert the results into a JSON response. Here's an example of how you might do this:

```javascript
const UserController = {
  async list(req, res) {
    const users = await User.findAll();
    const serializedUsers = serialize(users);
    res.json(serializedUsers);
  }
};

function serialize(users) {
  // use a separate serialization library or function to convert the users into a J
  // for example, you might use the jsonapi-serializer library like this:
  // const JSONAPISerializer = require('jsonapi-serializer').Serializer;
  // const serializedUsers = new JSONAPISerializer('users', {
  //   attributes: ['firstName', 'lastName', 'email']
  // }).serialize(users);
  return users.map(user => {
    return {
      id: user.id,
      firstName: user.firstName,
      lastName: user.lastName,
      email: user.email
    };
  });
}
```

In this example, we defined a controller function for the `list` endpoint that retrieves a list of users from the database using Sequelize and then uses a separate `serialize` function to convert the users into a JSON response. The `serialize` function could use any serialization library or custom logic to convert the Sequelize models into the desired format for the response.



A serializer is just a fancy word for transportable response builder right, atleast in the context of server APIs that return responses.

In general, a serializer is a component or library that is responsible for converting data from one format to another. In the context of server APIs that return responses, a serializer is typically used to convert data returned from the server into a format that can be easily consumed by clients, such as JSON or XML.

A serializer can be thought of as a response builder in the sense that it is responsible for constructing the response payload based on the data returned by the server. However, a serializer typically goes beyond just constructing a response payload, and can also handle complex data structures, relationships between records, and other serialization-related tasks.

A serializer can also provide a layer of abstraction between the server code and the client code, allowing the server to expose a consistent API interface while still allowing flexibility in the underlying data structures and formats.

In summary, a serializer is a key component in many server APIs that return responses, and is responsible for converting data from one format to another in a flexible and consistent manner.

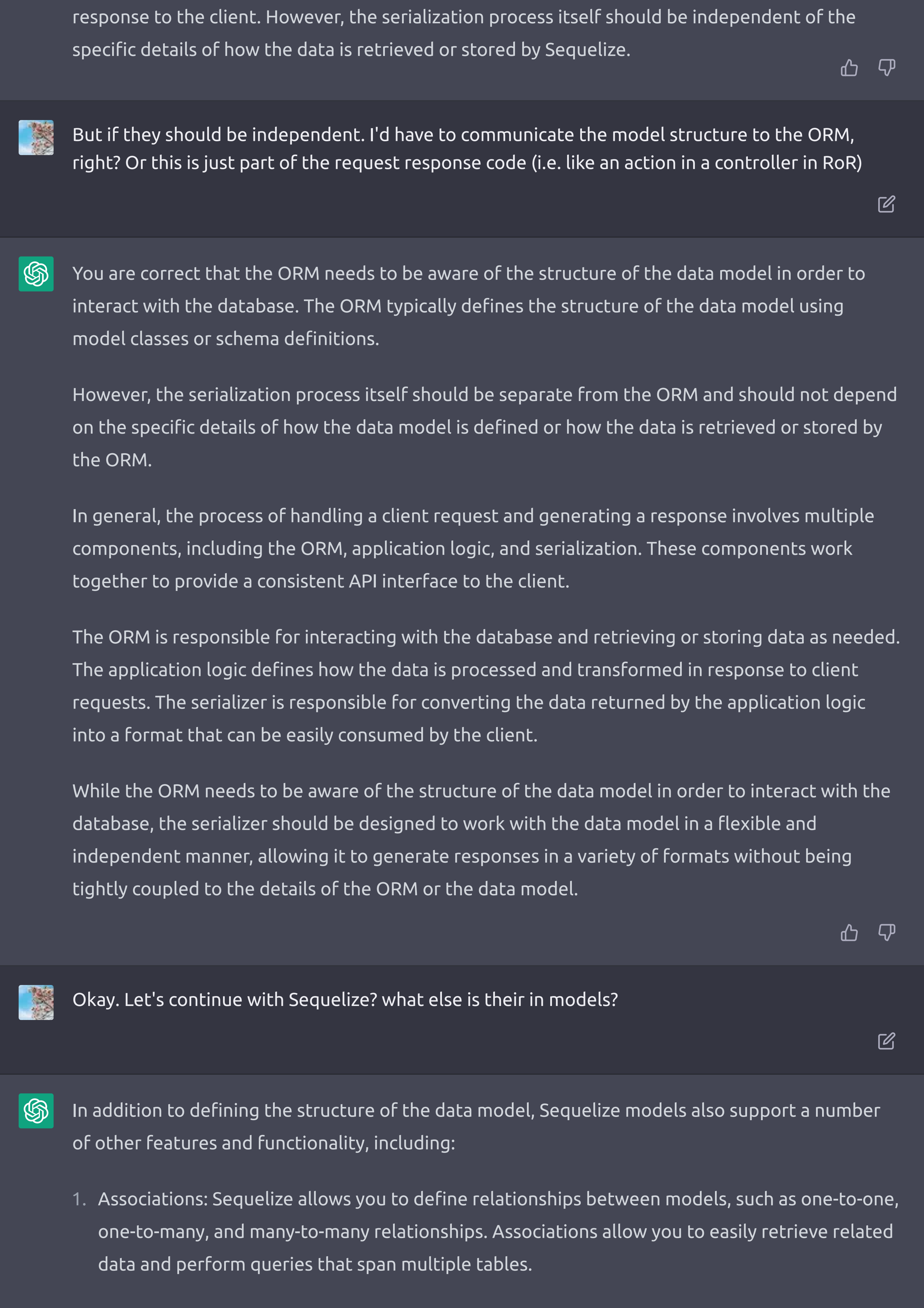
Do serialize care about the ORM?

Serialization is generally independent of the ORM (Object-Relational Mapping) library used by the server application.

In other words, the serialization process should not depend on the specific details of how the data is stored or retrieved from the database. Instead, the serializer should be able to work with any data structure or object that represents the data in a meaningful way.

While the specific details of how the data is represented may vary depending on the ORM used by the server application, the serializer should be able to work with any data structure or object that provides the necessary data in a standardized way.

For example, if a server application uses Sequelize as its ORM library, the serializer should be able to work with the Sequelize models or query results to convert them into a desired format for



response to the client. However, the serialization process itself should be independent of the specific details of how the data is retrieved or stored by Sequelize.

But if they should be independent. I'd have to communicate the model structure to the ORM, right? Or this is just part of the request response code (i.e. like an action in a controller in RoR)

You are correct that the ORM needs to be aware of the structure of the data model in order to interact with the database. The ORM typically defines the structure of the data model using model classes or schema definitions.

However, the serialization process itself should be separate from the ORM and should not depend on the specific details of how the data model is defined or how the data is retrieved or stored by the ORM.

In general, the process of handling a client request and generating a response involves multiple components, including the ORM, application logic, and serialization. These components work together to provide a consistent API interface to the client.

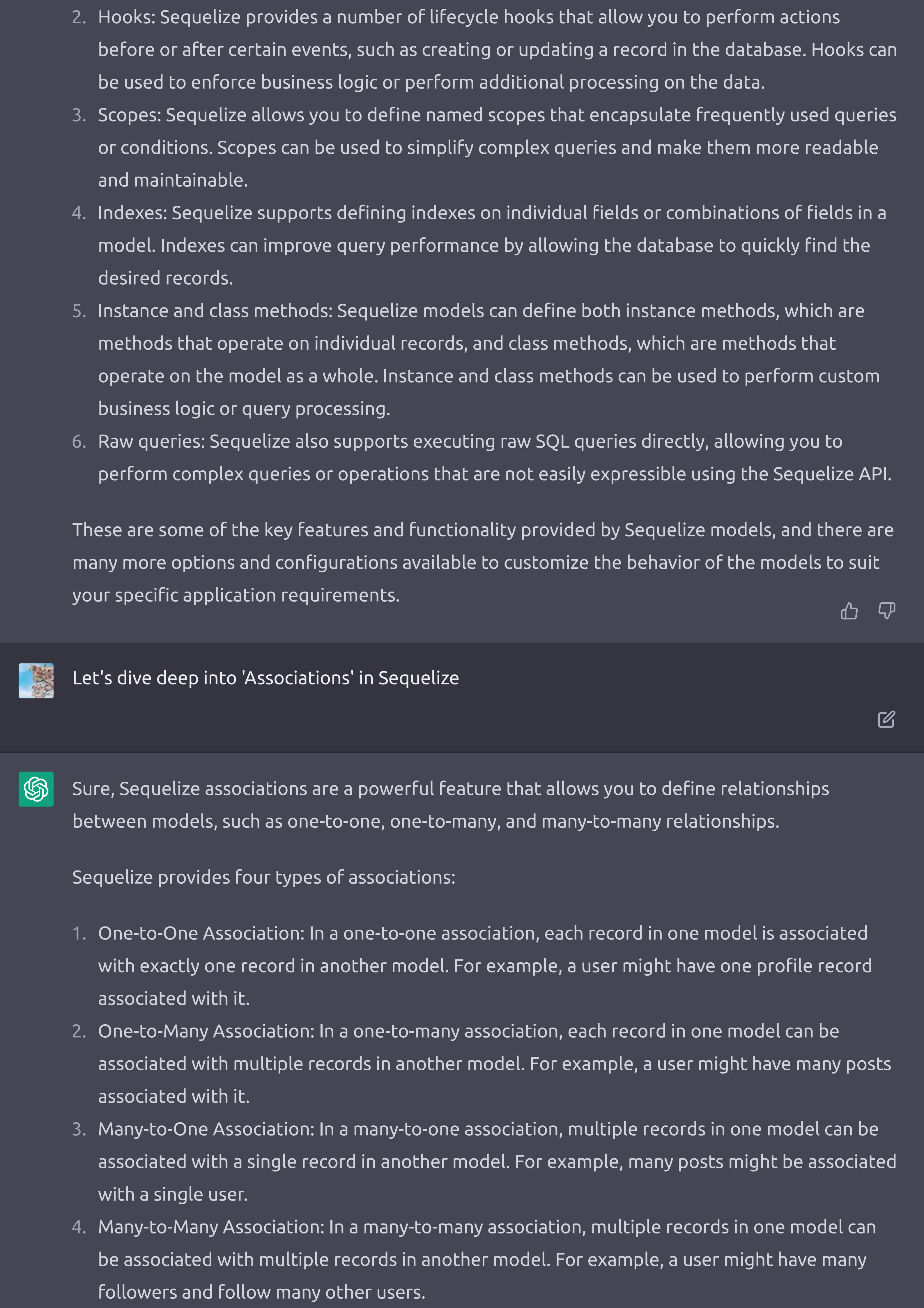
The ORM is responsible for interacting with the database and retrieving or storing data as needed. The application logic defines how the data is processed and transformed in response to client requests. The serializer is responsible for converting the data returned by the application logic into a format that can be easily consumed by the client.

While the ORM needs to be aware of the structure of the data model in order to interact with the database, the serializer should be designed to work with the data model in a flexible and independent manner, allowing it to generate responses in a variety of formats without being tightly coupled to the details of the ORM or the data model.

Okay. Let's continue with Sequelize? what else is their in models?

In addition to defining the structure of the data model, Sequelize models also support a number of other features and functionality, including:

1. Associations: Sequelize allows you to define relationships between models, such as one-to-one, one-to-many, and many-to-many relationships. Associations allow you to easily retrieve related data and perform queries that span multiple tables.



2. Hooks: Sequelize provides a number of lifecycle hooks that allow you to perform actions before or after certain events, such as creating or updating a record in the database. Hooks can be used to enforce business logic or perform additional processing on the data.
3. Scopes: Sequelize allows you to define named scopes that encapsulate frequently used queries or conditions. Scopes can be used to simplify complex queries and make them more readable and maintainable.
4. Indexes: Sequelize supports defining indexes on individual fields or combinations of fields in a model. Indexes can improve query performance by allowing the database to quickly find the desired records.
5. Instance and class methods: Sequelize models can define both instance methods, which are methods that operate on individual records, and class methods, which are methods that operate on the model as a whole. Instance and class methods can be used to perform custom business logic or query processing.
6. Raw queries: Sequelize also supports executing raw SQL queries directly, allowing you to perform complex queries or operations that are not easily expressible using the Sequelize API.

These are some of the key features and functionality provided by Sequelize models, and there are many more options and configurations available to customize the behavior of the models to suit your specific application requirements.

Let's dive deep into 'Associations' in Sequelize

Sure, Sequelize associations are a powerful feature that allows you to define relationships between models, such as one-to-one, one-to-many, and many-to-many relationships.

Sequelize provides four types of associations:

1. One-to-One Association: In a one-to-one association, each record in one model is associated with exactly one record in another model. For example, a user might have one profile record associated with it.
2. One-to-Many Association: In a one-to-many association, each record in one model can be associated with multiple records in another model. For example, a user might have many posts associated with it.
3. Many-to-One Association: In a many-to-one association, multiple records in one model can be associated with a single record in another model. For example, many posts might be associated with a single user.
4. Many-to-Many Association: In a many-to-many association, multiple records in one model can be associated with multiple records in another model. For example, a user might have many followers and follow many other users.

To define an association in Sequelize, you need to specify the type of association, the foreign key(s) that define the relationship, and any additional options or configuration.

Here's an example of how to define a one-to-many association between a User and Post model:

```js
// User model
const User = sequelize.define('User', {
  // ...
});

// Post model
const Post = sequelize.define('Post', {
  // ...
});

// Define the association
User.hasMany(Post);
Post.belongsTo(User);
```

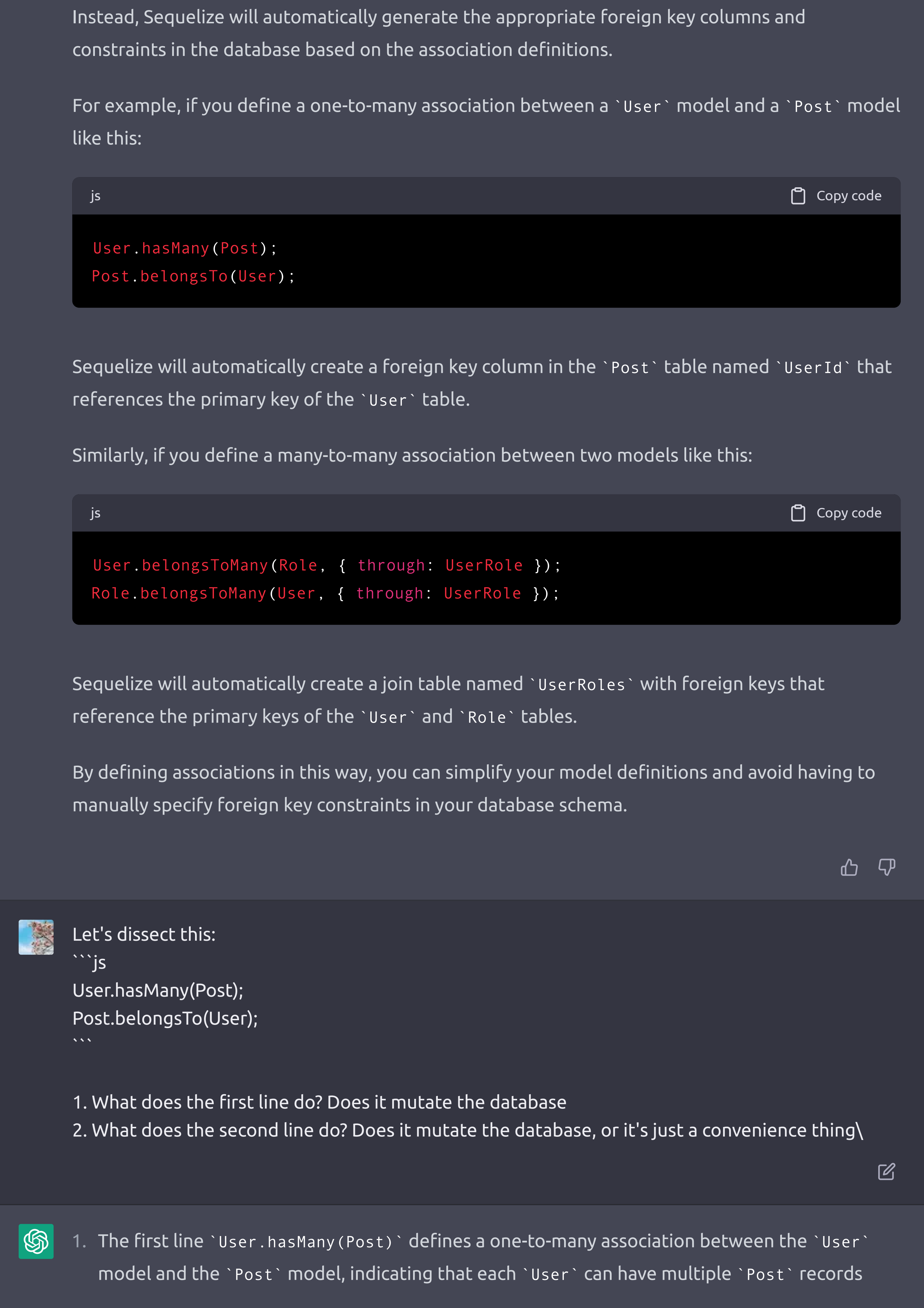
In this example, we define a one-to-many association between the User and Post models. The `User` model has many `Post` models associated with it, and the `Post` model belongs to a single `User` model.

The `hasMany` and `belongsTo` methods are used to define the association between the models. The `hasMany` method is called on the `User` model to specify that it has many `Post` models associated with it, while the `belongsTo` method is called on the `Post` model to specify that it belongs to a single `User` model.

Sequelize also supports many-to-many associations, as well as additional configuration options and features, such as specifying custom foreign keys, defining through models, and configuring eager loading.

If I use associations properly, I generally wouldn't need to use foreignKey in model definitions, right?

If you define associations properly in Sequelize, you generally do not need to explicitly specify the foreign keys in your model definitions.



Instead, Sequelize will automatically generate the appropriate foreign key columns and constraints in the database based on the association definitions.

For example, if you define a one-to-many association between a `User` model and a `Post` model like this:

```js
User.hasMany(Post);
Post.belongsTo(User);
```

Sequelize will automatically create a foreign key column in the `Post` table named `UserId` that references the primary key of the `User` table.

Similarly, if you define a many-to-many association between two models like this:

```js
User.belongsToMany(Role, { through: UserRole });
Role.belongsToMany(User, { through: UserRole });
```

Sequelize will automatically create a join table named `UserRoles` with foreign keys that reference the primary keys of the `User` and `Role` tables.

By defining associations in this way, you can simplify your model definitions and avoid having to manually specify foreign key constraints in your database schema.

Let's dissect this:

```js
User.hasMany(Post);
Post.belongsTo(User);
```

1. What does the first line do? Does it mutate the database
2. What does the second line do? Does it mutate the database, or it's just a convenience thing\

1. The first line `User.hasMany(Post)` defines a one-to-many association between the `User` model and the `Post` model, indicating that each `User` can have multiple `Post` records

associated with it. This association does not mutate the database directly, but it does define the relationship between the `User` and `Post` models in Sequelize. When you synchronize your Sequelize models with your database schema, Sequelize will automatically generate the appropriate foreign key column in the `Post` table to establish the association.

2. The second line `Post.belongsTo(User)` defines the inverse side of the association, indicating that each `Post` record belongs to a single `User`. Like the first line, this association does not mutate the database directly, but it does define the relationship between the `User` and `Post` models in Sequelize. When you synchronize your Sequelize models with your database schema, Sequelize will automatically generate the appropriate foreign key column in the `Post` table to establish the association.

Both lines are used to define the association between the models in Sequelize, and they work together to establish the relationship between the `User` and `Post` models in your application.

But 1-1 relations in SQL don't have a "polarity", how come the ORM has it?

In SQL, one-to-one relationships do not have a polarity because they can be represented in multiple ways. For example, you can represent a one-to-one relationship between a `User` and a `Profile` in SQL in either of the following ways:

1. Add a foreign key column to the `User` table that references the primary key of the `Profile` table.
2. Add a foreign key column to the `Profile` table that references the primary key of the `User` table.

However, in an ORM like Sequelize, which is designed to abstract away the details of the underlying database schema, it is useful to define a polarity for one-to-one relationships to simplify the model definitions and provide a clear and consistent API.

In Sequelize, the convention is to define one-to-one relationships using a `hasOne` association and a `belongsTo` association, where the `hasOne` association specifies the model that contains the foreign key and the `belongsTo` association specifies the model that owns the primary key.

For example, to define a one-to-one relationship between a `User` and a `Profile` model in Sequelize, you might use the following code:

```js
User.hasOne(Profile);
```

```js
Profile.belongsTo(User);
```

In this example, the `User` model has a one-to-one association with the `Profile` model, and the `hasOne` and `belongsTo` associations are used to define the polarity of the relationship. The `hasOne` association is called on the `User` model to specify that it has one `Profile` model associated with it, while the `belongsTo` association is called on the `Profile` model to specify that it belongs to a single `User` model.

By defining the polarity of one-to-one relationships in Sequelize, you can simplify your model definitions and provide a consistent API for working with related records.

Okay, ommitting one of these won't suffice?

If you omit one of the associations in a one-to-one relationship in Sequelize, you will not be able to define the relationship between the models correctly.

In a one-to-one relationship, both models must be associated with each other using a `hasOne` and a `belongsTo` association. If you only define one of the associations, Sequelize will not be able to create the necessary foreign key column and constraint in the database schema, and you will not be able to query or update related records correctly.

For example, if you only define the `hasOne` association on the `User` model like this:

js Copy code

```js
User.hasOne(Profile);
```

Sequelize will not be able to create the necessary foreign key column in the `Profile` table, and you will not be able to query or update related `Profile` records using the `User` model.

Similarly, if you only define the `belongsTo` association on the `Profile` model like this:

js Copy code

```js
Profile.belongsTo(User);
```

Sequelize will not be able to create the necessary foreign key column in the `User` table, and you will not be able to query or update related `User` records using the `Profile` model.

To define a one-to-one relationship correctly in Sequelize, you must specify both the `hasOne` and `belongsTo` associations on the respective models.

Okay, so atleast for 1-1 relations, providing both sides is necessary (from error POV) and desired right?

Yes, for one-to-one relationships in Sequelize, it is necessary to define both sides of the relationship using both the `hasOne` and `belongsTo` associations to avoid errors and to provide a clear and consistent API.

While it is technically possible to define a one-to-one relationship using only one of the associations, doing so would make it more difficult to query and update related records, and it could also result in unexpected behavior if the association is not defined consistently on both sides.

By defining both sides of the relationship using the `hasOne` and `belongsTo` associations, you can ensure that the relationship is defined consistently and that it is easy to query and update related records using either model. This can help make your code more maintainable and easier to understand.

Since this is a 1-1 relation (at the DB level, it's polarity less), swapping the functions with each other would have resulted in the same thing, right?

Yes, in a one-to-one relationship, you can swap the `hasOne` and `belongsTo` associations between the two models and still achieve the same result, since the relationship is symmetrical at the database level.

For example, instead of defining the `User` model with a `hasOne` association and the `Profile` model with a `belongsTo` association like this:

```js
User.hasOne(Profile);
Profile.belongsTo(User);
```

You could define the `User` model with a `belongsTo` association and the `Profile` model with a `hasOne` association like this:

```js
User.belongsTo(Profile);
Profile.hasOne(User);
```

In this case, the resulting database schema and behavior would be identical to the first example, since the relationship is still a one-to-one relationship, and the two associations are simply swapped between the two models. However, it is generally considered best practice to be consistent in your use of the `hasOne` and `belongsTo` associations to make your code easier to read and understand.

By consistent, you mean have the "logical"/common-sense combination right?

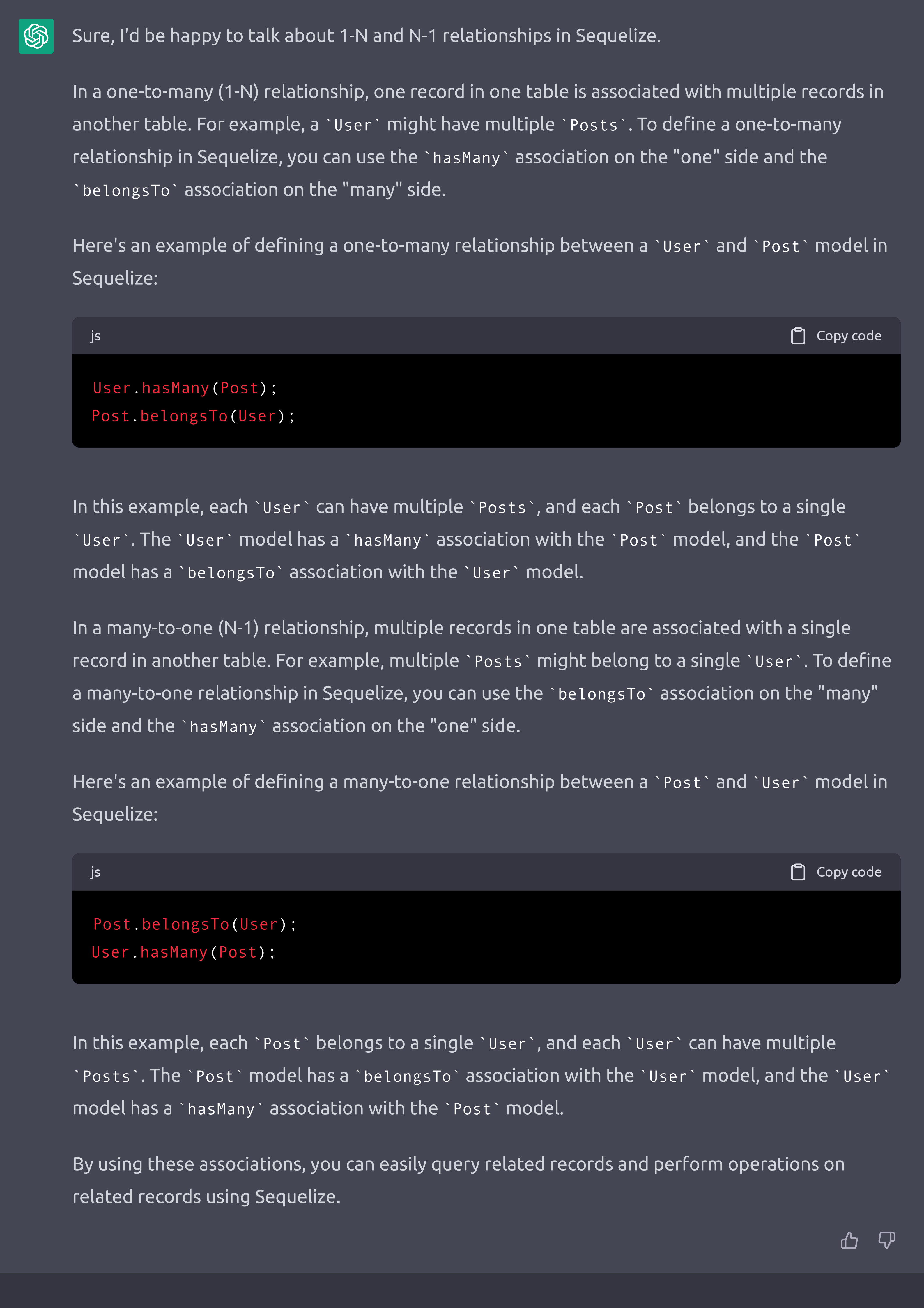
Yes, by consistent, I mean that you should use the `hasOne` and `belongsTo` associations in a way that makes logical sense for your application and your data model.

For example, if you have a one-to-one relationship between a `User` and a `Profile`, you might choose to define the `User` model with a `hasOne` association and the `Profile` model with a `belongsTo` association, since it makes sense for the `Profile` model to "belong to" a single `User` model.

On the other hand, if you have a one-to-one relationship between a `Product` and a `Price`, you might choose to define the `Product` model with a `belongsTo` association and the `Price` model with a `hasOne` association, since it makes sense for the `Price` to "belong to" a single `Product`.

By being consistent in your use of the `hasOne` and `belongsTo` associations, you can make your code easier to read and understand, and you can avoid confusion or errors caused by inconsistent or illogical associations.

Okay let's talk about 1-N, and N-1 relations?



Sure, I'd be happy to talk about 1-N and N-1 relationships in Sequelize.

In a one-to-many (1-N) relationship, one record in one table is associated with multiple records in another table. For example, a `User` might have multiple `Posts`. To define a one-to-many relationship in Sequelize, you can use the `hasMany` association on the "one" side and the `belongsTo` association on the "many" side.

Here's an example of defining a one-to-many relationship between a `User` and `Post` model in Sequelize:

```js
User.hasMany(Post);
Post.belongsTo(User);
```

In this example, each `User` can have multiple `Posts`, and each `Post` belongs to a single `User`. The `User` model has a `hasMany` association with the `Post` model, and the `Post` model has a `belongsTo` association with the `User` model.

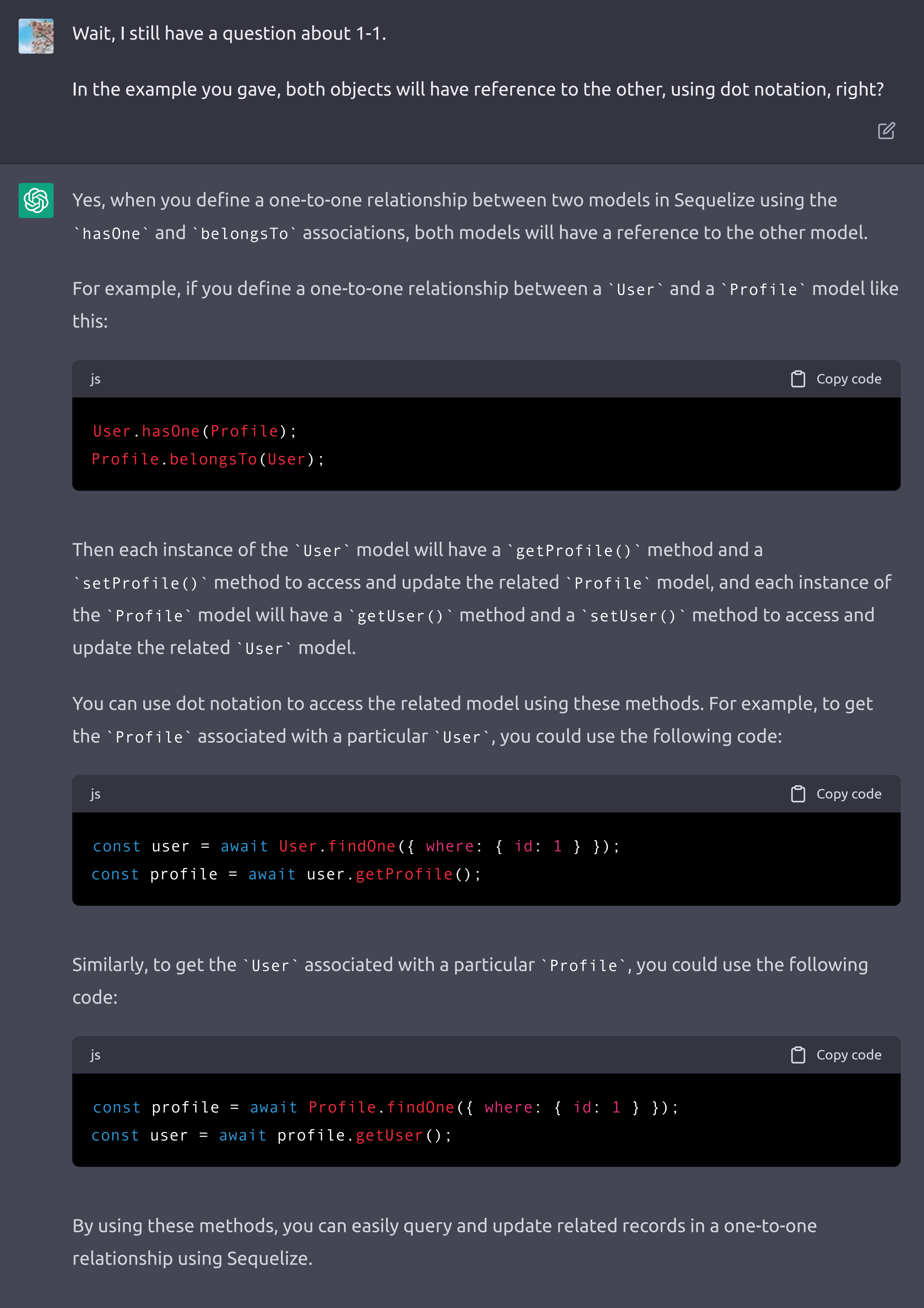
In a many-to-one (N-1) relationship, multiple records in one table are associated with a single record in another table. For example, multiple `Posts` might belong to a single `User`. To define a many-to-one relationship in Sequelize, you can use the `belongsTo` association on the "many" side and the `hasMany` association on the "one" side.

Here's an example of defining a many-to-one relationship between a `Post` and `User` model in Sequelize:

```js
Post.belongsTo(User);
User.hasMany(Post);
```

In this example, each `Post` belongs to a single `User`, and each `User` can have multiple `Posts`. The `Post` model has a `belongsTo` association with the `User` model, and the `User` model has a `hasMany` association with the `Post` model.

By using these associations, you can easily query related records and perform operations on related records using Sequelize.



Wait, I still have a question about 1-1.

In the example you gave, both objects will have reference to the other, using dot notation, right?

Yes, when you define a one-to-one relationship between two models in Sequelize using the `hasOne` and `belongsTo` associations, both models will have a reference to the other model.

For example, if you define a one-to-one relationship between a `User` and a `Profile` model like this:

```js
User.hasOne(Profile);
Profile.belongsTo(User);
```

Then each instance of the `User` model will have a `getProfile()` method and a `setProfile()` method to access and update the related `Profile` model, and each instance of the `Profile` model will have a `getUser()` method and a `setUser()` method to access and update the related `User` model.

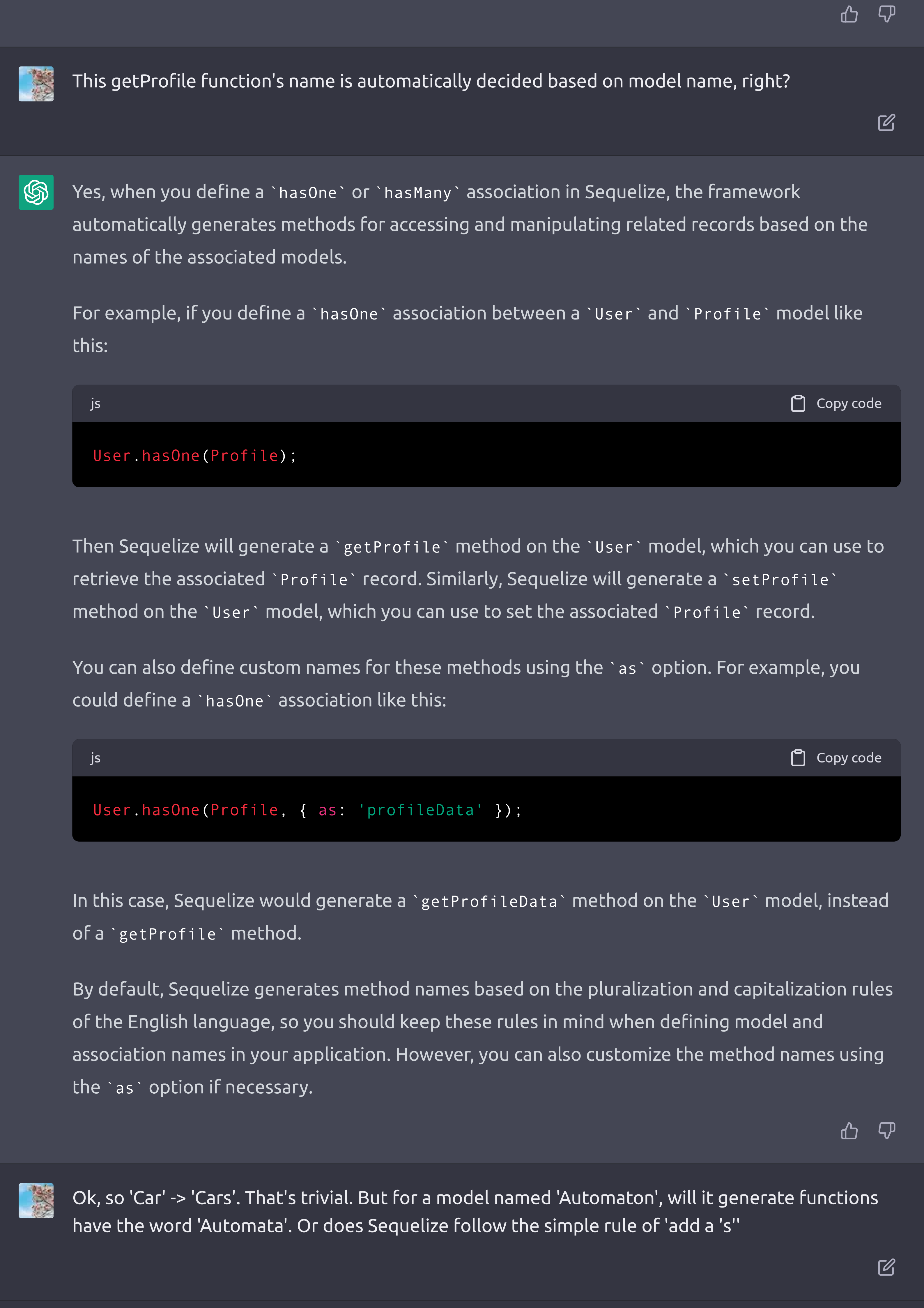
You can use dot notation to access the related model using these methods. For example, to get the `Profile` associated with a particular `User`, you could use the following code:

```js
const user = await User.findOne({ where: { id: 1 } });
const profile = await user.getProfile();
```

Similarly, to get the `User` associated with a particular `Profile`, you could use the following code:

```js
const profile = await Profile.findOne({ where: { id: 1 } });
const user = await profile.getUser();
```

By using these methods, you can easily query and update related records in a one-to-one relationship using Sequelize.



This getProfile function's name is automatically decided based on model name, right?

Yes, when you define a `hasOne` or `hasMany` association in Sequelize, the framework automatically generates methods for accessing and manipulating related records based on the names of the associated models.

For example, if you define a `hasOne` association between a `User` and `Profile` model like this:

```js
User.hasOne(Profile);
```

Then Sequelize will generate a `getProfile` method on the `User` model, which you can use to retrieve the associated `Profile` record. Similarly, Sequelize will generate a `setProfile` method on the `User` model, which you can use to set the associated `Profile` record.

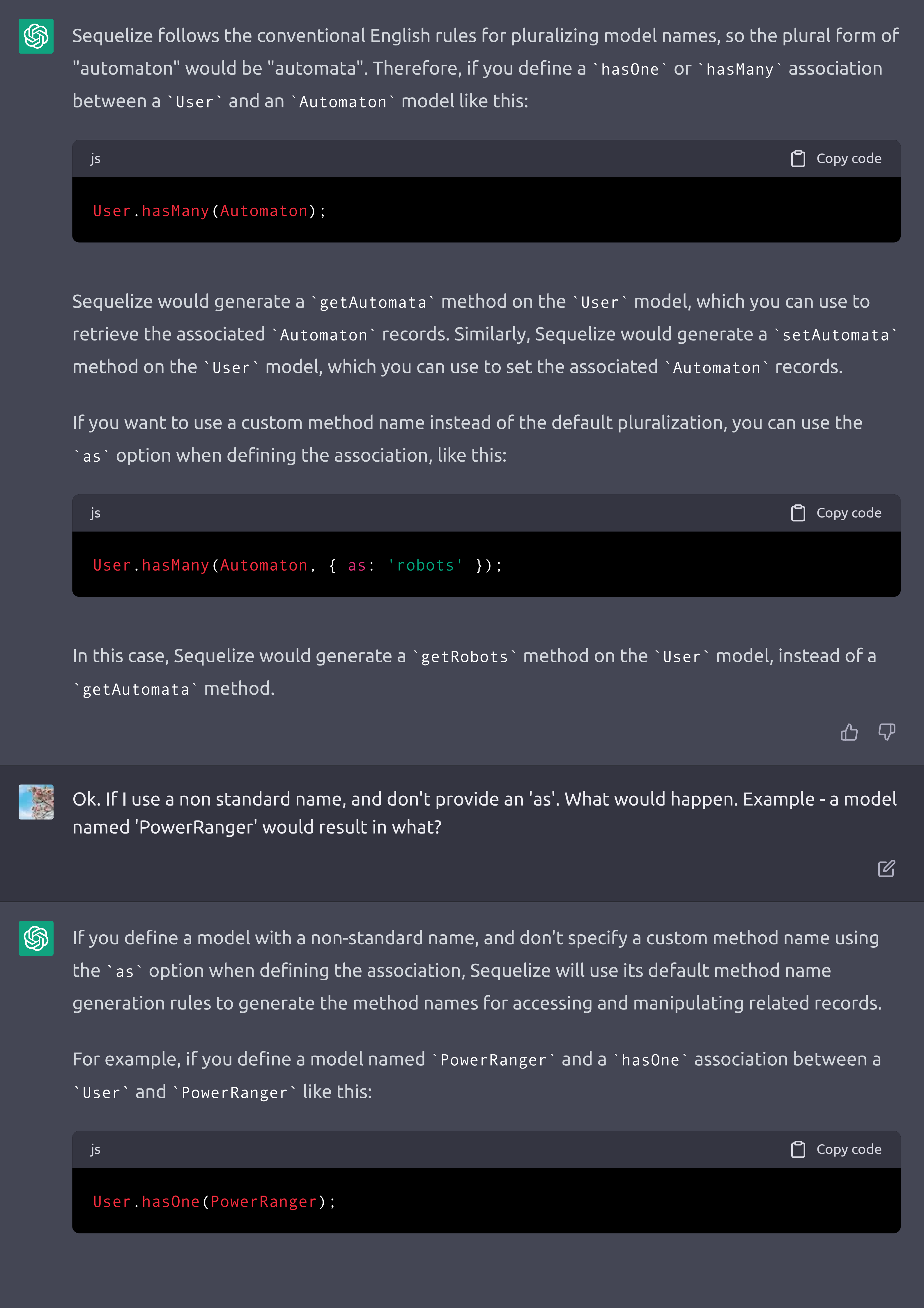
You can also define custom names for these methods using the `as` option. For example, you could define a `hasOne` association like this:

```js
User.hasOne(Profile, { as: 'profileData' });
```

In this case, Sequelize would generate a `getProfileData` method on the `User` model, instead of a `getProfile` method.

By default, Sequelize generates method names based on the pluralization and capitalization rules of the English language, so you should keep these rules in mind when defining model and association names in your application. However, you can also customize the method names using the `as` option if necessary.

Ok, so 'Car' -> 'Cars'. That's trivial. But for a model named 'Automaton', will it generate functions have the word 'Automata'. Or does Sequelize follow the simple rule of 'add a 's''



Sequelize follows the conventional English rules for pluralizing model names, so the plural form of "automaton" would be "automata". Therefore, if you define a `hasOne` or `hasMany` association between a `User` and an `Automaton` model like this:

```js
User.hasMany(Automaton);
```

Sequelize would generate a `getAutomata` method on the `User` model, which you can use to retrieve the associated `Automaton` records. Similarly, Sequelize would generate a `setAutomata` method on the `User` model, which you can use to set the associated `Automaton` records.

If you want to use a custom method name instead of the default pluralization, you can use the `as` option when defining the association, like this:

```js
User.hasMany(Automaton, { as: 'robots' });
```

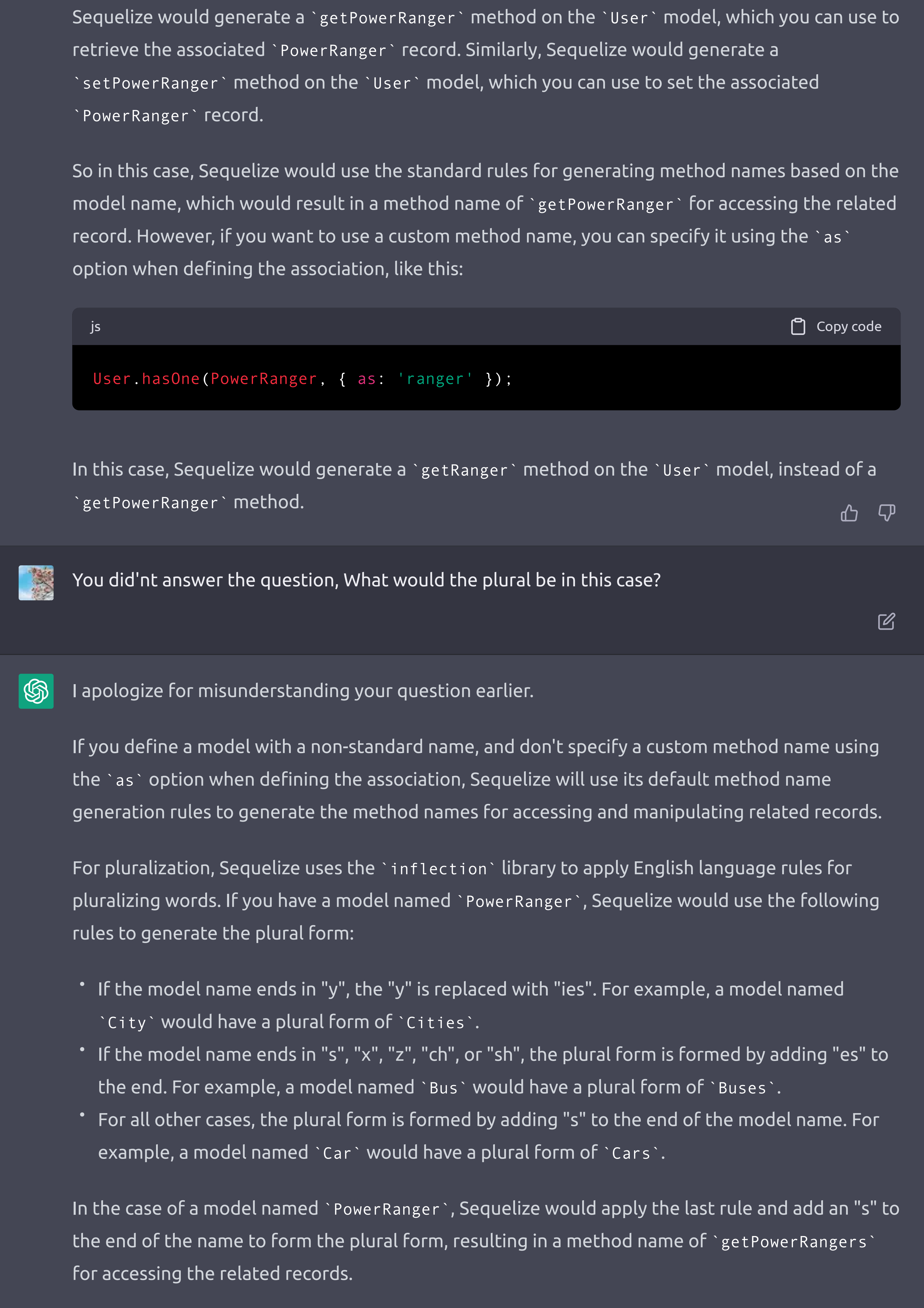
In this case, Sequelize would generate a `getRobots` method on the `User` model, instead of a `getAutomata` method.

Ok. If I use a non standard name, and don't provide an 'as'. What would happen. Example - a model named 'PowerRanger' would result in what?

If you define a model with a non-standard name, and don't specify a custom method name using the `as` option when defining the association, Sequelize will use its default method name generation rules to generate the method names for accessing and manipulating related records.

For example, if you define a model named `PowerRanger` and a `hasOne` association between a `User` and `PowerRanger` like this:

```js
User.hasOne(PowerRanger);
```



Sequelize would generate a `getPowerRanger` method on the `User` model, which you can use to retrieve the associated `PowerRanger` record. Similarly, Sequelize would generate a `setPowerRanger` method on the `User` model, which you can use to set the associated `PowerRanger` record.

So in this case, Sequelize would use the standard rules for generating method names based on the model name, which would result in a method name of `getPowerRanger` for accessing the related record. However, if you want to use a custom method name, you can specify it using the `as` option when defining the association, like this:

```js
User.hasOne(PowerRanger, { as: 'ranger' });
```

In this case, Sequelize would generate a `getRanger` method on the `User` model, instead of a `getPowerRanger` method.

You did'nt answer the question, What would the plural be in this case?

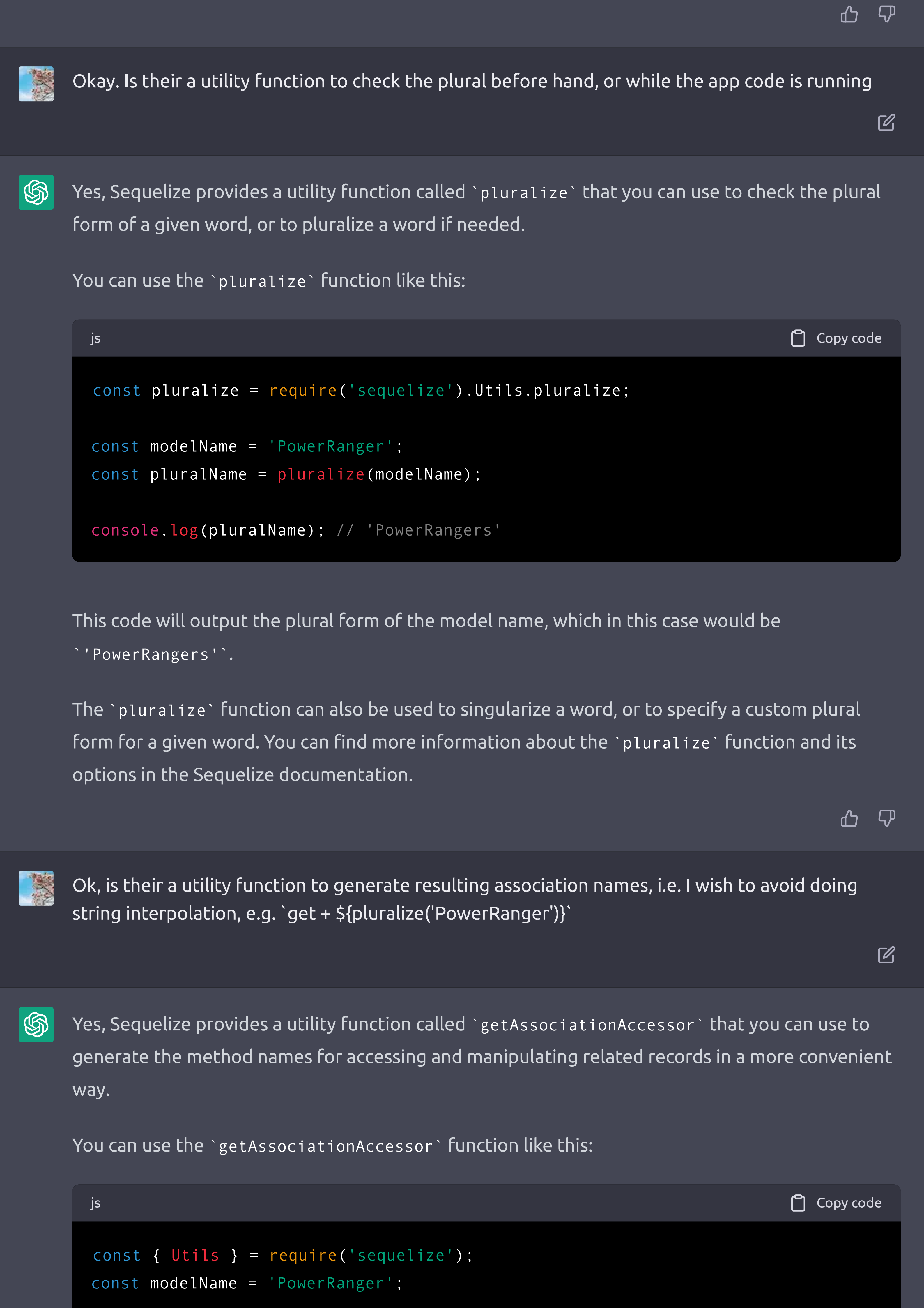
I apologize for misunderstanding your question earlier.

If you define a model with a non-standard name, and don't specify a custom method name using the `as` option when defining the association, Sequelize will use its default method name generation rules to generate the method names for accessing and manipulating related records.

For pluralization, Sequelize uses the `inflection` library to apply English language rules for pluralizing words. If you have a model named `PowerRanger`, Sequelize would use the following rules to generate the plural form:

- If the model name ends in "y", the "y" is replaced with "ies". For example, a model named `City` would have a plural form of `Cities`.
- If the model name ends in "s", "x", "z", "ch", or "sh", the plural form is formed by adding "es" to the end. For example, a model named `Bus` would have a plural form of `Buses`.
- For all other cases, the plural form is formed by adding "s" to the end of the model name. For example, a model named `Car` would have a plural form of `Cars`.

In the case of a model named `PowerRanger`, Sequelize would apply the last rule and add an "s" to the end of the name to form the plural form, resulting in a method name of `getPowerRangers` for accessing the related records.



Okay. Is their a utility function to check the plural before hand, or while the app code is running

Yes, Sequelize provides a utility function called `pluralize` that you can use to check the plural form of a given word, or to pluralize a word if needed.

You can use the `pluralize` function like this:

```js
const pluralize = require('sequelize').Utils.pluralize;

const modelName = 'PowerRanger';
const pluralName = pluralize(modelName);

console.log(pluralName); // 'PowerRangers'
```

This code will output the plural form of the model name, which in this case would be `'PowerRangers'`.

The `pluralize` function can also be used to singularize a word, or to specify a custom plural form for a given word. You can find more information about the `pluralize` function and its options in the Sequelize documentation.

Ok, is their a utility function to generate resulting association names, i.e. I wish to avoid doing string interpolation, e.g. `get + ${pluralize('PowerRanger')}`

Yes, Sequelize provides a utility function called `getAssociationAccessor` that you can use to generate the method names for accessing and manipulating related records in a more convenient way.

You can use the `getAssociationAccessor` function like this:

```js
const { Utils } = require('sequelize');
const modelName = 'PowerRanger';
const pluralName = Utils.pluralize(modelName);

const getMethod = Utils.getAssociationAccessor(pluralName, 'get', modelName);
const setMethod = Utils.getAssociationAccessor(pluralName, 'set', modelName);
const addMethod = Utils.getAssociationAccessor(pluralName, 'add', modelName);
const removeMethod = Utils.getAssociationAccessor(pluralName, 'remove', modelName);

console.log(getMethod); // 'getPowerRangers'
console.log(setMethod); // 'setPowerRangers'
console.log(addMethod); // 'addPowerRanger'
console.log(removeMethod); // 'removePowerRanger'
```

This code will output the method names for accessing and manipulating related records for a model named `` `'PowerRanger'` ``, using the `` `getAssociationAccessor` `` function to generate the names based on the model name and the type of method (e.g. `` `get` ``, `` `set` ``, `` `add` ``, `` `remove` ``). The resulting method names will be `` `'getPowerRangers'` ``, `` `'setPowerRangers'` ``, `` `'addPowerRanger'` ``, and `` `'removePowerRanger'` ``.

By using the `` `getAssociationAccessor` `` function, you can avoid the need for string interpolation when defining associations, and instead rely on a consistent and predictable method name generation scheme.

Okay. How to get list of all "useful" properties and methods of a model?

In Sequelize, you can use the `` `prototype` `` property of a model to access its methods and properties. The `` `prototype` `` property is an object that represents the model's instance methods and properties.

Here's an example of how to access the `` `prototype` `` property of a model:

js Copy code

```js
const User = sequelize.define('User', {
  firstName: DataTypes.STRING,
  lastName: DataTypes.STRING,
  email: DataTypes.STRING,
  password: DataTypes.STRING
});

console.log(Object.getOwnPropertyNames(User.prototype));
```

This code will output an array of all the property names of the `User` model's `prototype`, including its instance methods and properties.

In addition to the `prototype` property, Sequelize also provides several other methods and properties for working with models and their associations. You can find more information about these methods and properties in the Sequelize documentation.

Let's cotinue with 1-N and N-1. Start from the beginning, please

Sure, let's start with 1-N relationships.

In a 1-N relationship, one record in a table can be associated with multiple records in another table, but each record in the second table can only be associated with one record in the first table.

For example, a blog post can have multiple comments, but each comment can only belong to one post. To define a 1-N relationship between two models in Sequelize, you can use the `hasMany` and `belongsTo` methods, just like in the 1-1 relationship case.

Here's an example of how to define a 1-N relationship between a `Post` model and a `Comment` model:

```js
// Define the Post model
const Post = sequelize.define('Post', {
  title: DataTypes.STRING,
  content: DataTypes.TEXT
});

// Define the Comment model
const Comment = sequelize.define('Comment', {
  text: DataTypes.TEXT
});

// Define the 1-N association
Post.hasMany(Comment);
Comment.belongsTo(Post);
```

In this example, we use the `hasMany` method to define a 1-N relationship between the `Post` model and the `Comment` model. This means that each `Post` can have many `Comment` records associated with it.

We also use the `belongsTo` method to define the inverse relationship between the `Comment` and `Post` models. This means that each `Comment` record belongs to exactly one `Post`.

You can then use the generated methods and properties to access and manipulate related records. For example, you can use the `getComments` method to retrieve all comments associated with a given post:

js Copy code

```js
const post = await Post.findByPk(1);
const comments = await post.getComments();
```

In the same way, you can use the generated `setComments`, `addComment`, and `removeComment` methods to modify the associated comments.

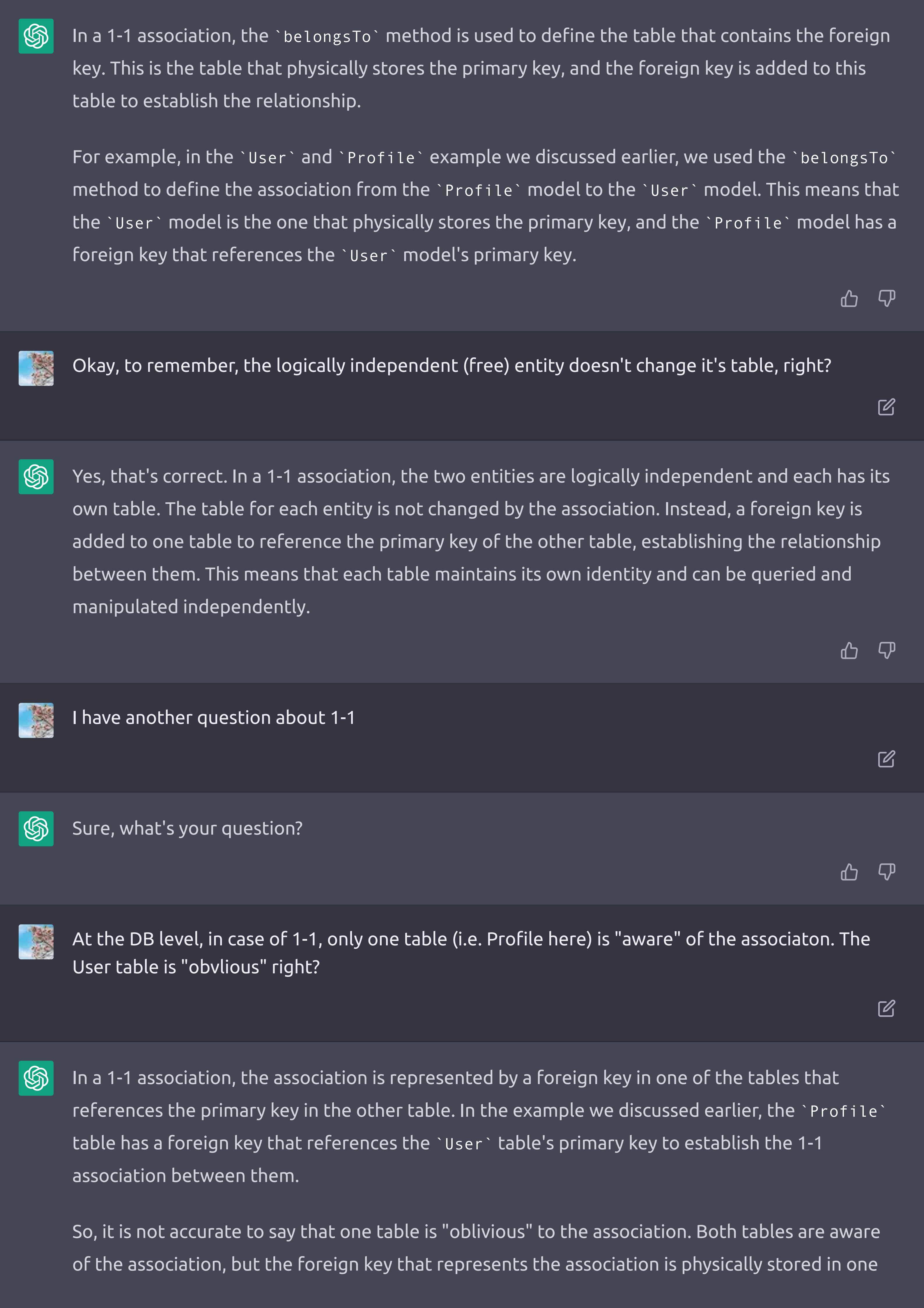
Now, let's move on to N-1 relationships.

Wait. In the 1-1 association, primary key is physically created only in one table, right (even if I associated both ways)?

Yes, that's correct. In a 1-1 association, one table's primary key is used as a foreign key in the other table to establish the relationship. This means that only one table physically has the primary key, even if the association is defined both ways.

For example, in the `User` and `Profile` example we discussed earlier, the `User` model has the primary key `id`, which is used as a foreign key in the `Profile` model to establish the 1-1 relationship. Even though we defined the association both ways, the `Profile` table does not have its own primary key, and instead uses the `User` table's primary key as a foreign key.

Which table is the key created in. belongsTo one or hasOne



In a 1-1 association, the `belongsTo` method is used to define the table that contains the foreign key. This is the table that physically stores the primary key, and the foreign key is added to this table to establish the relationship.

For example, in the `User` and `Profile` example we discussed earlier, we used the `belongsTo` method to define the association from the `Profile` model to the `User` model. This means that the `User` model is the one that physically stores the primary key, and the `Profile` model has a foreign key that references the `User` model's primary key.

Okay, to remember, the logically independent (free) entity doesn't change it's table, right?

Yes, that's correct. In a 1-1 association, the two entities are logically independent and each has its own table. The table for each entity is not changed by the association. Instead, a foreign key is added to one table to reference the primary key of the other table, establishing the relationship between them. This means that each table maintains its own identity and can be queried and manipulated independently.

I have another question about 1-1

Sure, what's your question?

At the DB level, in case of 1-1, only one table (i.e. Profile here) is "aware" of the associaton. The User table is "obvlious" right?

In a 1-1 association, the association is represented by a foreign key in one of the tables that references the primary key in the other table. In the example we discussed earlier, the `Profile` table has a foreign key that references the `User` table's primary key to establish the 1-1 association between them.

So, it is not accurate to say that one table is "oblivious" to the association. Both tables are aware of the association, but the foreign key that represents the association is physically stored in one

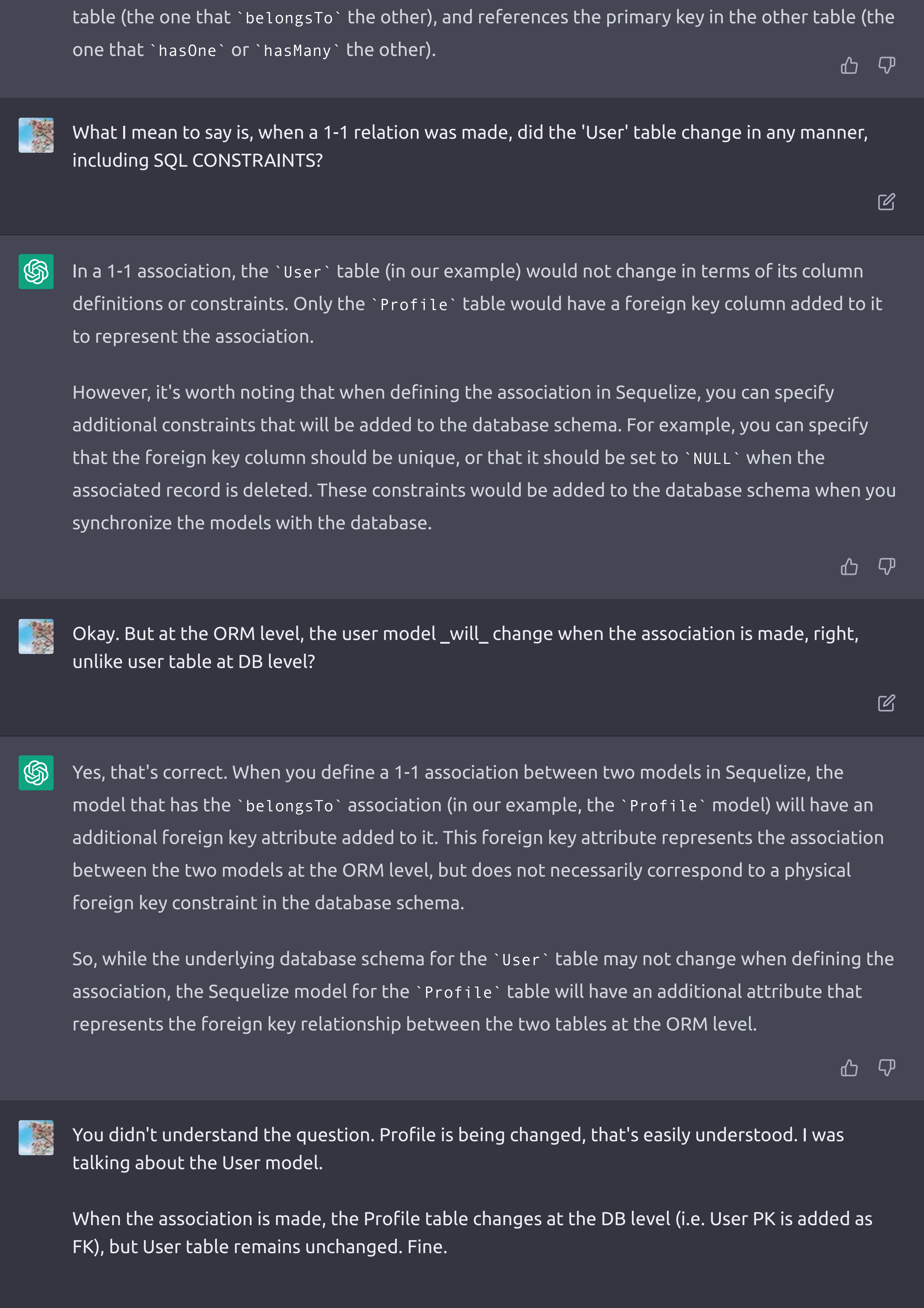


table (the one that `belongsTo` the other), and references the primary key in the other table (the one that `hasOne` or `hasMany` the other).

What I mean to say is, when a 1-1 relation was made, did the 'User' table change in any manner, including SQL CONSTRAINTS?

In a 1-1 association, the `User` table (in our example) would not change in terms of its column definitions or constraints. Only the `Profile` table would have a foreign key column added to it to represent the association.

However, it's worth noting that when defining the association in Sequelize, you can specify additional constraints that will be added to the database schema. For example, you can specify that the foreign key column should be unique, or that it should be set to `NULL` when the associated record is deleted. These constraints would be added to the database schema when you synchronize the models with the database.

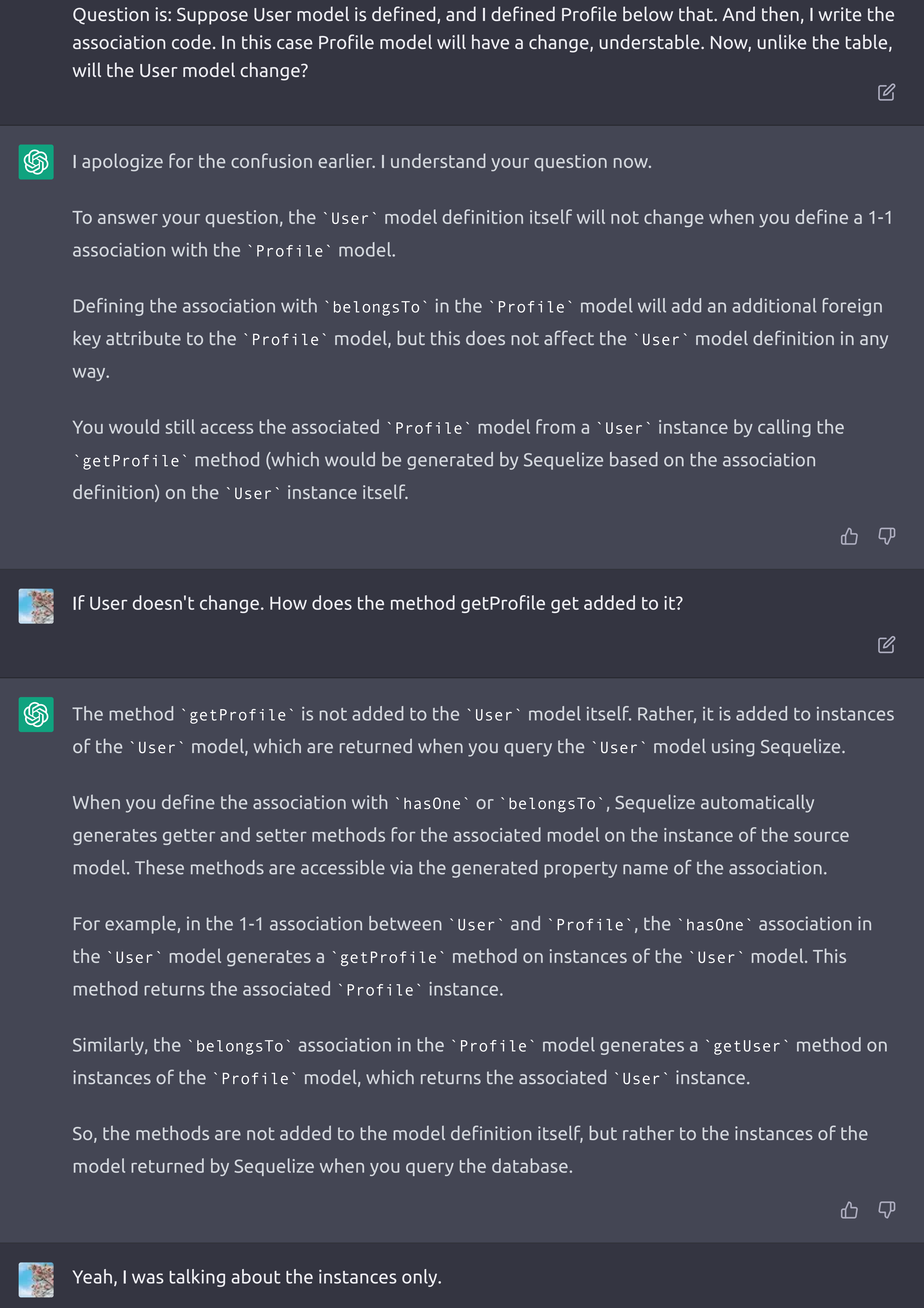
Okay. But at the ORM level, the user model _will_ change when the association is made, right, unlike user table at DB level?

Yes, that's correct. When you define a 1-1 association between two models in Sequelize, the model that has the `belongsTo` association (in our example, the `Profile` model) will have an additional foreign key attribute added to it. This foreign key attribute represents the association between the two models at the ORM level, but does not necessarily correspond to a physical foreign key constraint in the database schema.

So, while the underlying database schema for the `User` table may not change when defining the association, the Sequelize model for the `Profile` table will have an additional attribute that represents the foreign key relationship between the two tables at the ORM level.

You didn't understand the question. Profile is being changed, that's easily understood. I was talking about the User model.

When the association is made, the Profile table changes at the DB level (i.e. User PK is added as FK), but User table remains unchanged. Fine.



Question is: Suppose User model is defined, and I defined Profile below that. And then, I write the association code. In this case Profile model will have a change, understable. Now, unlike the table, will the User model change?

I apologize for the confusion earlier. I understand your question now.

To answer your question, the `User` model definition itself will not change when you define a 1-1 association with the `Profile` model.

Defining the association with `belongsTo` in the `Profile` model will add an additional foreign key attribute to the `Profile` model, but this does not affect the `User` model definition in any way.

You would still access the associated `Profile` model from a `User` instance by calling the `getProfile` method (which would be generated by Sequelize based on the association definition) on the `User` instance itself.

If User doesn't change. How does the method getProfile get added to it?

The method `getProfile` is not added to the `User` model itself. Rather, it is added to instances of the `User` model, which are returned when you query the `User` model using Sequelize.

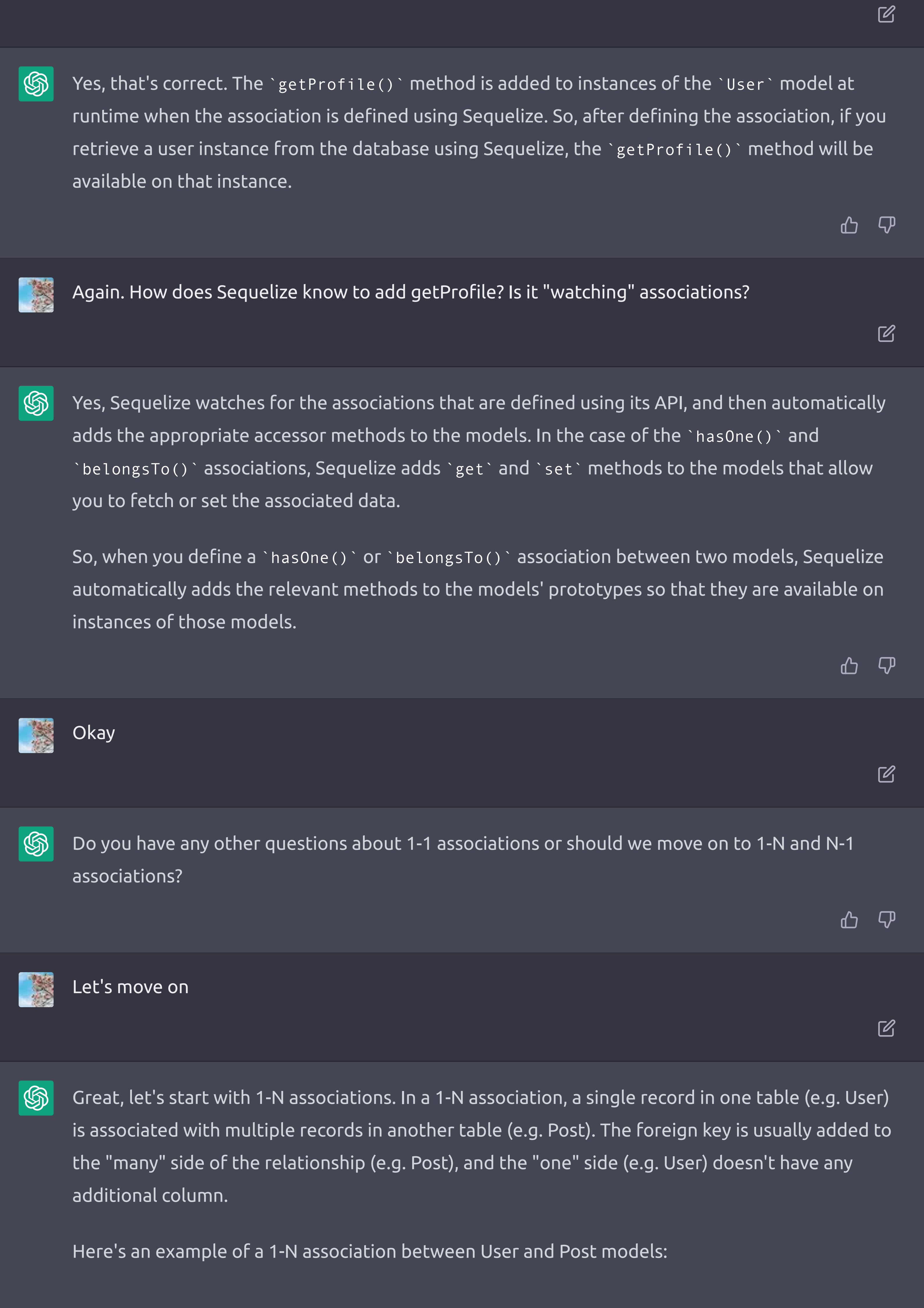
When you define the association with `hasOne` or `belongsTo`, Sequelize automatically generates getter and setter methods for the associated model on the instance of the source model. These methods are accessible via the generated property name of the association.

For example, in the 1-1 association between `User` and `Profile`, the `hasOne` association in the `User` model generates a `getProfile` method on instances of the `User` model. This method returns the associated `Profile` instance.

Similarly, the `belongsTo` association in the `Profile` model generates a `getUser` method on instances of the `Profile` model, which returns the associated `User` instance.

So, the methods are not added to the model definition itself, but rather to the instances of the model returned by Sequelize when you query the database.

Yeah, I was talking about the instances only.



Yes, that's correct. The `getProfile()` method is added to instances of the `User` model at runtime when the association is defined using Sequelize. So, after defining the association, if you retrieve a user instance from the database using Sequelize, the `getProfile()` method will be available on that instance.

Again. How does Sequelize know to add getProfile? Is it "watching" associations?

Yes, Sequelize watches for the associations that are defined using its API, and then automatically adds the appropriate accessor methods to the models. In the case of the `hasOne()` and `belongsTo()` associations, Sequelize adds `get` and `set` methods to the models that allow you to fetch or set the associated data.

So, when you define a `hasOne()` or `belongsTo()` association between two models, Sequelize automatically adds the relevant methods to the models' prototypes so that they are available on instances of those models.

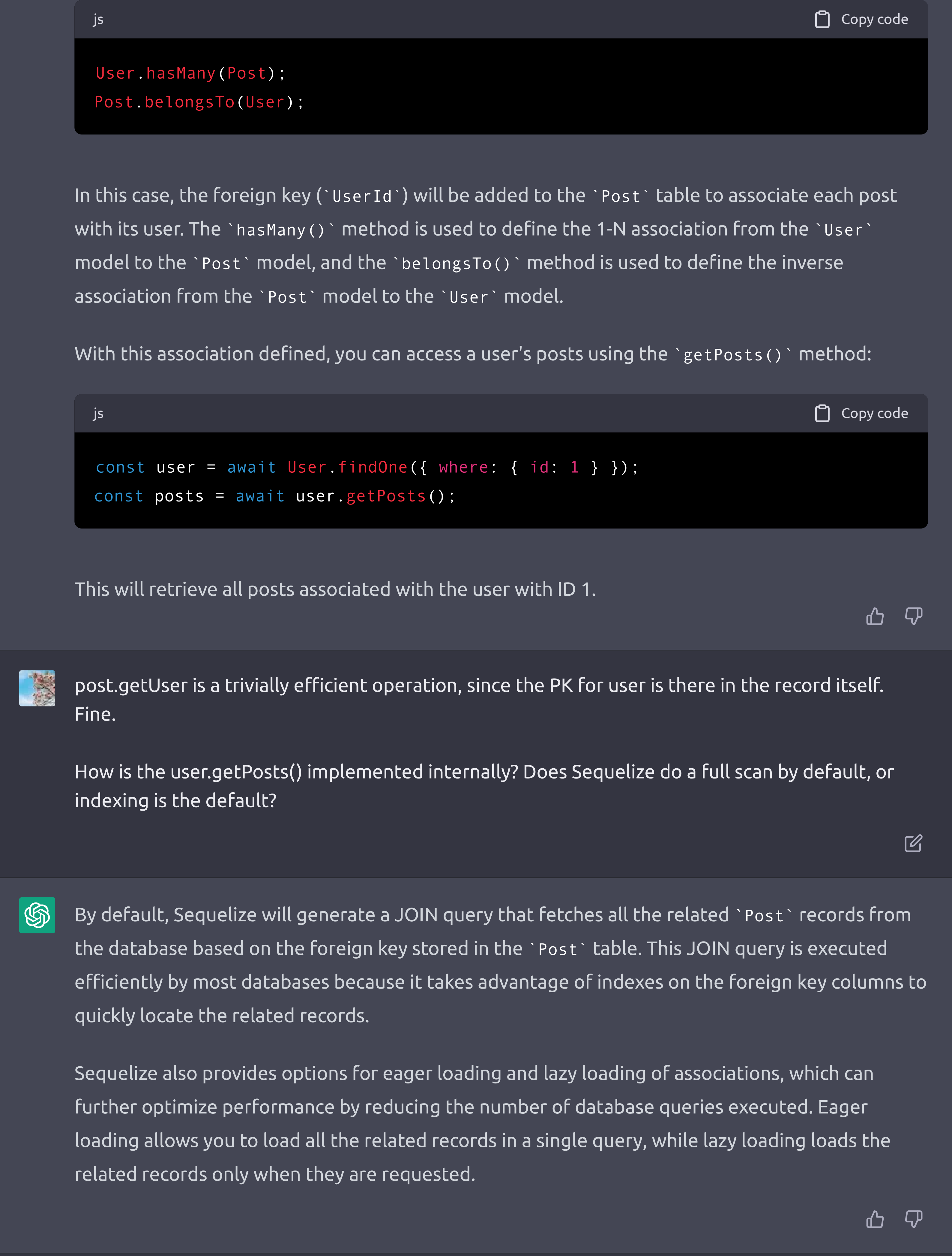
Okay

Do you have any other questions about 1-1 associations or should we move on to 1-N and N-1 associations?

Let's move on

Great, let's start with 1-N associations. In a 1-N association, a single record in one table (e.g. User) is associated with multiple records in another table (e.g. Post). The foreign key is usually added to the "many" side of the relationship (e.g. Post), and the "one" side (e.g. User) doesn't have any additional column.

Here's an example of a 1-N association between User and Post models:



```js
User.hasMany(Post);
Post.belongsTo(User);
```

In this case, the foreign key (`UserId`) will be added to the `Post` table to associate each post with its user. The `hasMany()` method is used to define the 1-N association from the `User` model to the `Post` model, and the `belongsTo()` method is used to define the inverse association from the `Post` model to the `User` model.

With this association defined, you can access a user's posts using the `getPosts()` method:

```js
const user = await User.findOne({ where: { id: 1 } });
const posts = await user.getPosts();
```

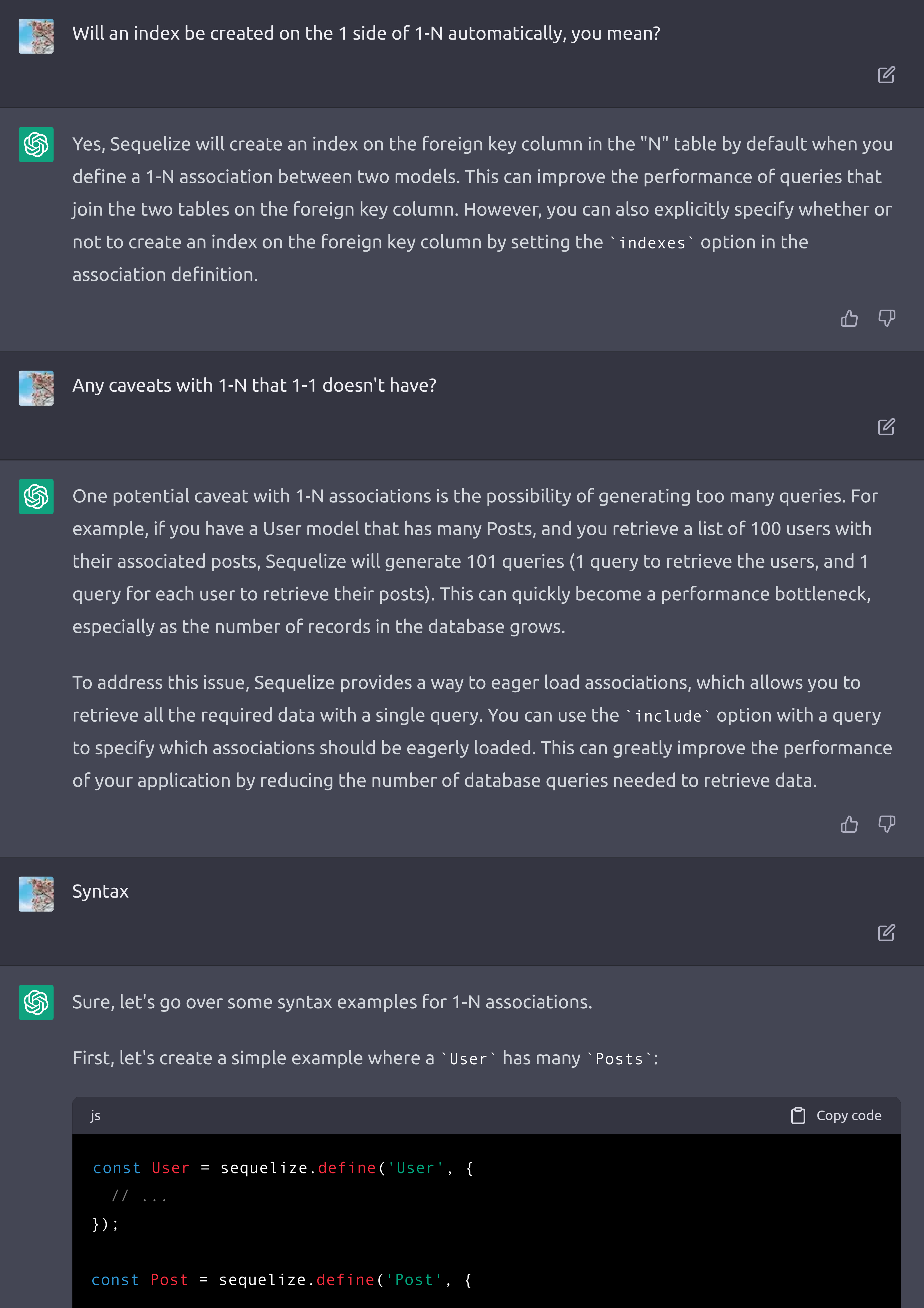
This will retrieve all posts associated with the user with ID 1.

post.getUser is a trivially efficient operation, since the PK for user is there in the record itself. Fine.

How is the user.getPosts() implemented internally? Does Sequelize do a full scan by default, or indexing is the default?

By default, Sequelize will generate a JOIN query that fetches all the related `Post` records from the database based on the foreign key stored in the `Post` table. This JOIN query is executed efficiently by most databases because it takes advantage of indexes on the foreign key columns to quickly locate the related records.

Sequelize also provides options for eager loading and lazy loading of associations, which can further optimize performance by reducing the number of database queries executed. Eager loading allows you to load all the related records in a single query, while lazy loading loads the related records only when they are requested.



Will an index be created on the 1 side of 1-N automatically, you mean?

Yes, Sequelize will create an index on the foreign key column in the "N" table by default when you define a 1-N association between two models. This can improve the performance of queries that join the two tables on the foreign key column. However, you can also explicitly specify whether or not to create an index on the foreign key column by setting the `indexes` option in the association definition.

Any caveats with 1-N that 1-1 doesn't have?

One potential caveat with 1-N associations is the possibility of generating too many queries. For example, if you have a User model that has many Posts, and you retrieve a list of 100 users with their associated posts, Sequelize will generate 101 queries (1 query to retrieve the users, and 1 query for each user to retrieve their posts). This can quickly become a performance bottleneck, especially as the number of records in the database grows.

To address this issue, Sequelize provides a way to eager load associations, which allows you to retrieve all the required data with a single query. You can use the `include` option with a query to specify which associations should be eagerly loaded. This can greatly improve the performance of your application by reducing the number of database queries needed to retrieve data.

Syntax

Sure, let's go over some syntax examples for 1-N associations.

First, let's create a simple example where a `User` has many `Posts`:

```js
const User = sequelize.define('User', {
  // ...
});

const Post = sequelize.define('Post', {
  // ...
});

User.hasMany(Post);
Post.belongsTo(User);
```

Here we're using the `hasMany` method on the `User` model and the `belongsTo` method on the `Post` model to create a 1-N association between them. This will create a foreign key `UserId` in the `Post` model that references the `id` primary key in the `User` model.

We can also add additional options to the association, such as `onDelete` or `onUpdate`, to specify what should happen to the associated records when a `User` record is deleted or updated:

```js
User.hasMany(Post, { onDelete: 'CASCADE', onUpdate: 'CASCADE' });
Post.belongsTo(User, { onDelete: 'CASCADE', onUpdate: 'CASCADE' });
```

In this example, we're specifying that when a `User` record is deleted or updated, all associated `Post` records should also be deleted or updated, respectively.

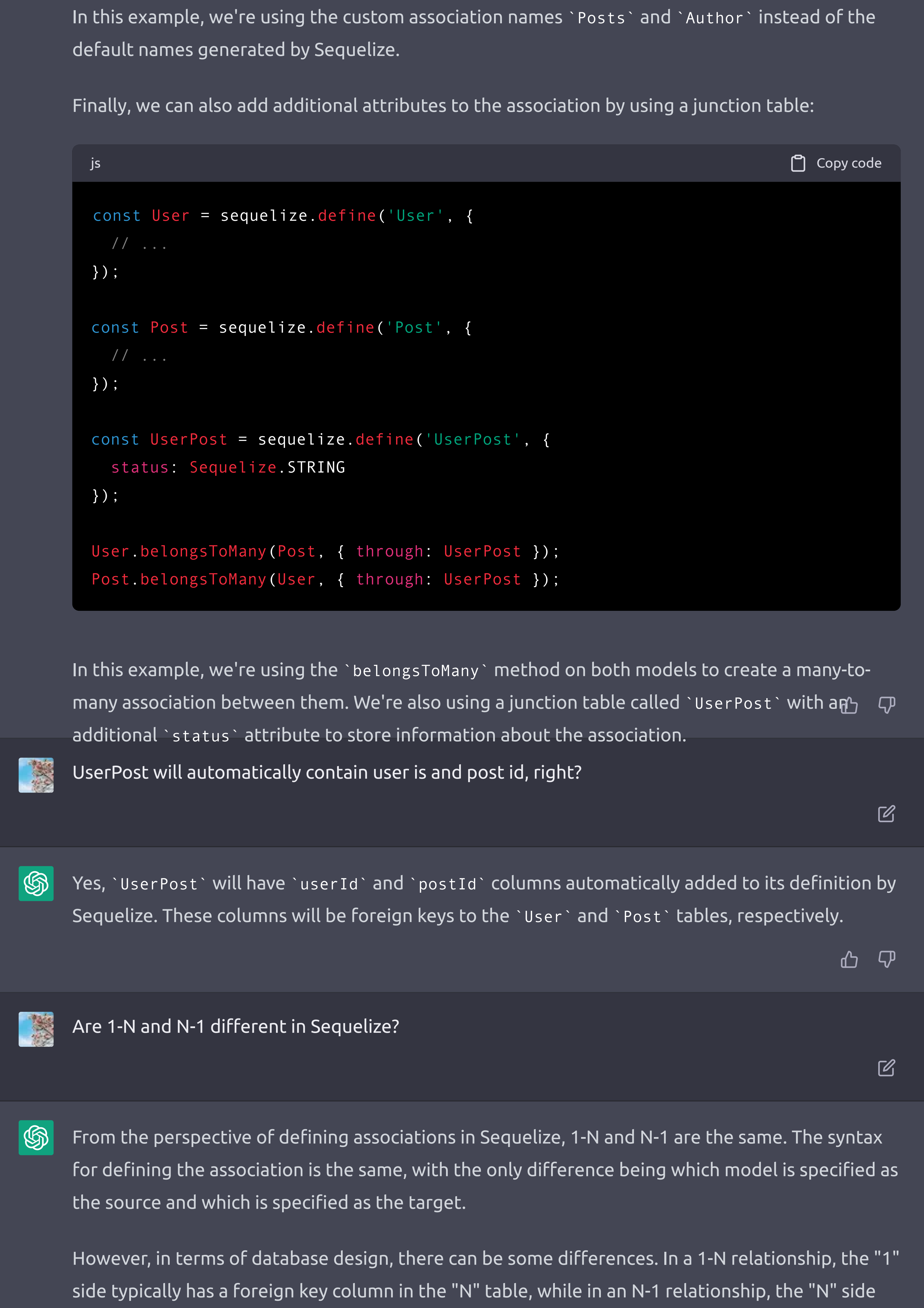
We can also specify custom foreign key names:

```js
User.hasMany(Post, { foreignKey: 'authorId' });
Post.belongsTo(User, { foreignKey: 'authorId' });
```

In this example, we're using the custom foreign key name `authorId` instead of the default `UserId`.

We can also specify a custom name for the association itself:

```js
User.hasMany(Post, { as: 'Posts' });
Post.belongsTo(User, { as: 'Author' });
```



In this example, we're using the custom association names `Posts` and `Author` instead of the default names generated by Sequelize.

Finally, we can also add additional attributes to the association by using a junction table:

```js
const User = sequelize.define('User', {
  // ...
});

const Post = sequelize.define('Post', {
  // ...
});

const UserPost = sequelize.define('UserPost', {
  status: Sequelize.STRING
});

User.belongsToMany(Post, { through: UserPost });
Post.belongsToMany(User, { through: UserPost });
```

In this example, we're using the `belongsToMany` method on both models to create a many-to-many association between them. We're also using a junction table called `UserPost` with an additional `status` attribute to store information about the association.

UserPost will automatically contain user is and post id, right?

Yes, `UserPost` will have `userId` and `postId` columns automatically added to its definition by Sequelize. These columns will be foreign keys to the `User` and `Post` tables, respectively.

Are 1-N and N-1 different in Sequelize?

From the perspective of defining associations in Sequelize, 1-N and N-1 are the same. The syntax for defining the association is the same, with the only difference being which model is specified as the source and which is specified as the target.

However, in terms of database design, there can be some differences. In a 1-N relationship, the "1" side typically has a foreign key column in the "N" table, while in an N-1 relationship, the "N" side has a foreign key column in the "1" table. This can affect things like database indexing and querying performance.

Clarify: even in case of 1-N (Posts with Author). The Author table, at the DB level, remains unchanged, right?

Yes, that is correct. In a 1-N relationship between Posts and Author, the Author table at the DB level remains unchanged. The foreign key `authorId` is added to the Posts table to establish the relationship, but the Author table remains the same.

Clarify: in 1-N relations, hasMany and belongsTo cannot be interchanged, like with 1-1 right. Since here, it'd change the whole meaning?

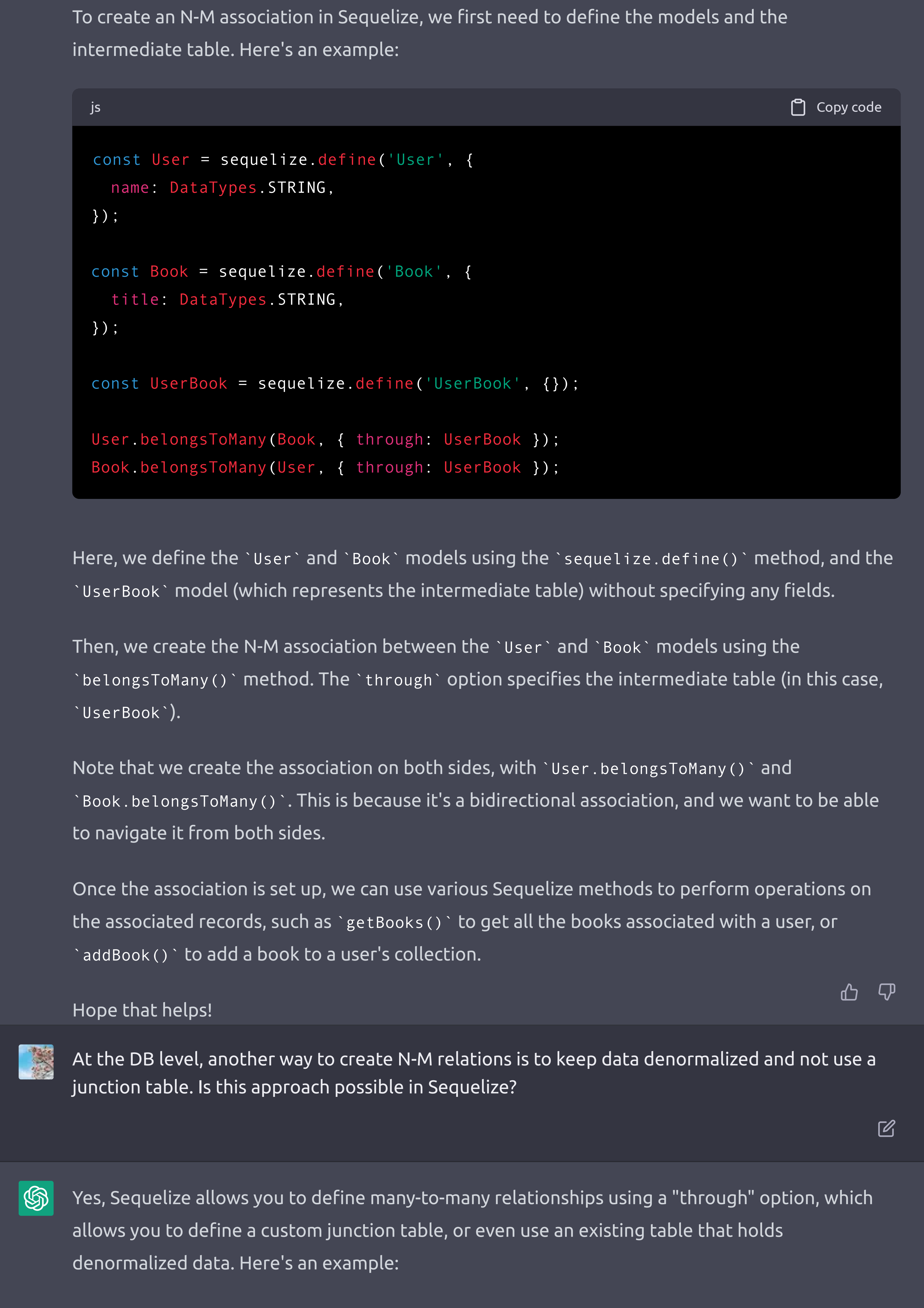
Yes, that's correct. In a 1-N relationship, `hasMany` and `belongsTo` cannot be interchanged as they have different meanings. `hasMany` specifies that the foreign key is on the N side and `belongsTo` specifies that the foreign key is on the 1 side. Interchanging them would change the meaning of the relationship, and also cause errors in Sequelize.

Let's talk about N-M associations

Sure, let's talk about N-M associations in Sequelize.

In Sequelize, an N-M (many-to-many) association represents a relationship between two tables where each record in one table can be associated with multiple records in another table, and vice versa.

For example, consider the following scenario: a `User` can have many `Books`, and a `Book` can be associated with many `Users`. This is a many-to-many relationship, and can be represented using an intermediate table, say `UserBook`, which will have foreign keys to both the `User` and `Book` tables.



To create an N-M association in Sequelize, we first need to define the models and the intermediate table. Here's an example:

```js
const User = sequelize.define('User', {
  name: DataTypes.STRING,
});

const Book = sequelize.define('Book', {
  title: DataTypes.STRING,
});

const UserBook = sequelize.define('UserBook', {});

User.belongsToMany(Book, { through: UserBook });
Book.belongsToMany(User, { through: UserBook });
```

Here, we define the `User` and `Book` models using the `sequelize.define()` method, and the `UserBook` model (which represents the intermediate table) without specifying any fields.

Then, we create the N-M association between the `User` and `Book` models using the `belongsToMany()` method. The `through` option specifies the intermediate table (in this case, `UserBook`).

Note that we create the association on both sides, with `User.belongsToMany()` and `Book.belongsToMany()`. This is because it's a bidirectional association, and we want to be able to navigate it from both sides.

Once the association is set up, we can use various Sequelize methods to perform operations on the associated records, such as `getBooks()` to get all the books associated with a user, or `addBook()` to add a book to a user's collection.

Hope that helps!

At the DB level, another way to create N-M relations is to keep data denormalized and not use a junction table. Is this approach possible in Sequelize?

Yes, Sequelize allows you to define many-to-many relationships using a "through" option, which allows you to define a custom junction table, or even use an existing table that holds denormalized data. Here's an example:

```js
const User = sequelize.define('User', {/* ... */});
const Group = sequelize.define('Group', {/* ... */});

User.belongsToMany(Group, {
  through: 'UserGroups',
  foreignKey: 'userId'
});

Group.belongsToMany(User, {
  through: 'UserGroups',
  foreignKey: 'groupId'
});
```

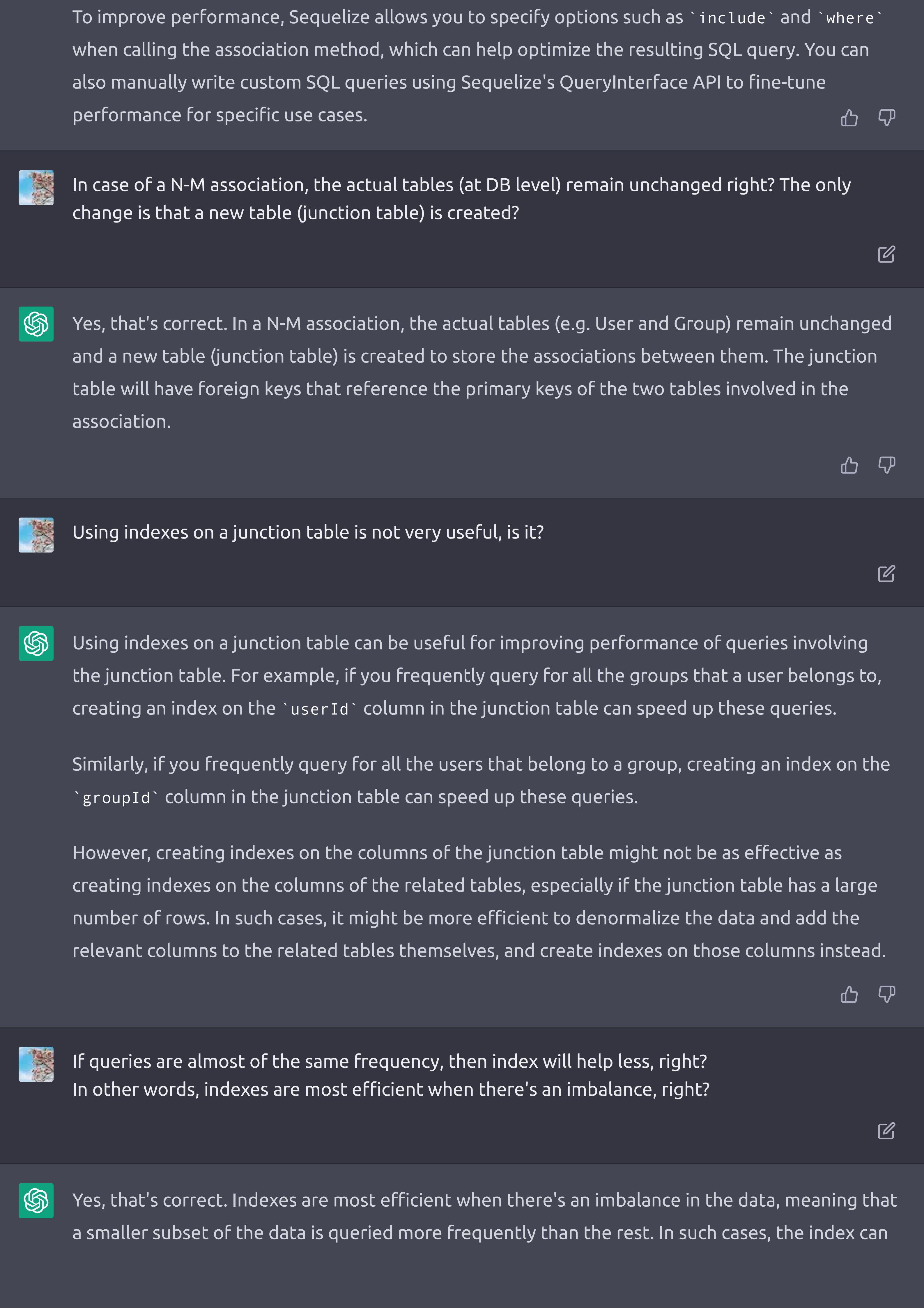
In the above example, we are defining a many-to-many relationship between users and groups using a custom junction table called `UserGroups`. The `foreignKey` option specifies the name of the foreign key columns in the junction table. If the junction table already exists and has different column names, you can use the `through` option to specify the name of the junction table, and Sequelize will use those column names to generate the appropriate SQL queries.

You didn't get the question. Can I have N-M relations without a through table, in Sequelize?

No, Sequelize requires the use of a junction table to create N-M relations. This is because the junction table allows Sequelize to keep track of the many-to-many relationship between two tables, and store any additional information related to that relationship.

Let's talk about query performance (read) here. doing User.getGroups() would require a full scan of the junction table, right?

Yes, calling `User.getGroups()` would require Sequelize to perform a query to retrieve all rows from the junction table associated with the user, and then perform additional queries to retrieve the actual group objects from the `Groups` table. This can potentially be a slow operation if the junction table is large and not properly indexed.



To improve performance, Sequelize allows you to specify options such as `include` and `where` when calling the association method, which can help optimize the resulting SQL query. You can also manually write custom SQL queries using Sequelize's QueryInterface API to fine-tune performance for specific use cases.

In case of a N-M association, the actual tables (at DB level) remain unchanged right? The only change is that a new table (junction table) is created?

Yes, that's correct. In a N-M association, the actual tables (e.g. User and Group) remain unchanged and a new table (junction table) is created to store the associations between them. The junction table will have foreign keys that reference the primary keys of the two tables involved in the association.

Using indexes on a junction table is not very useful, is it?

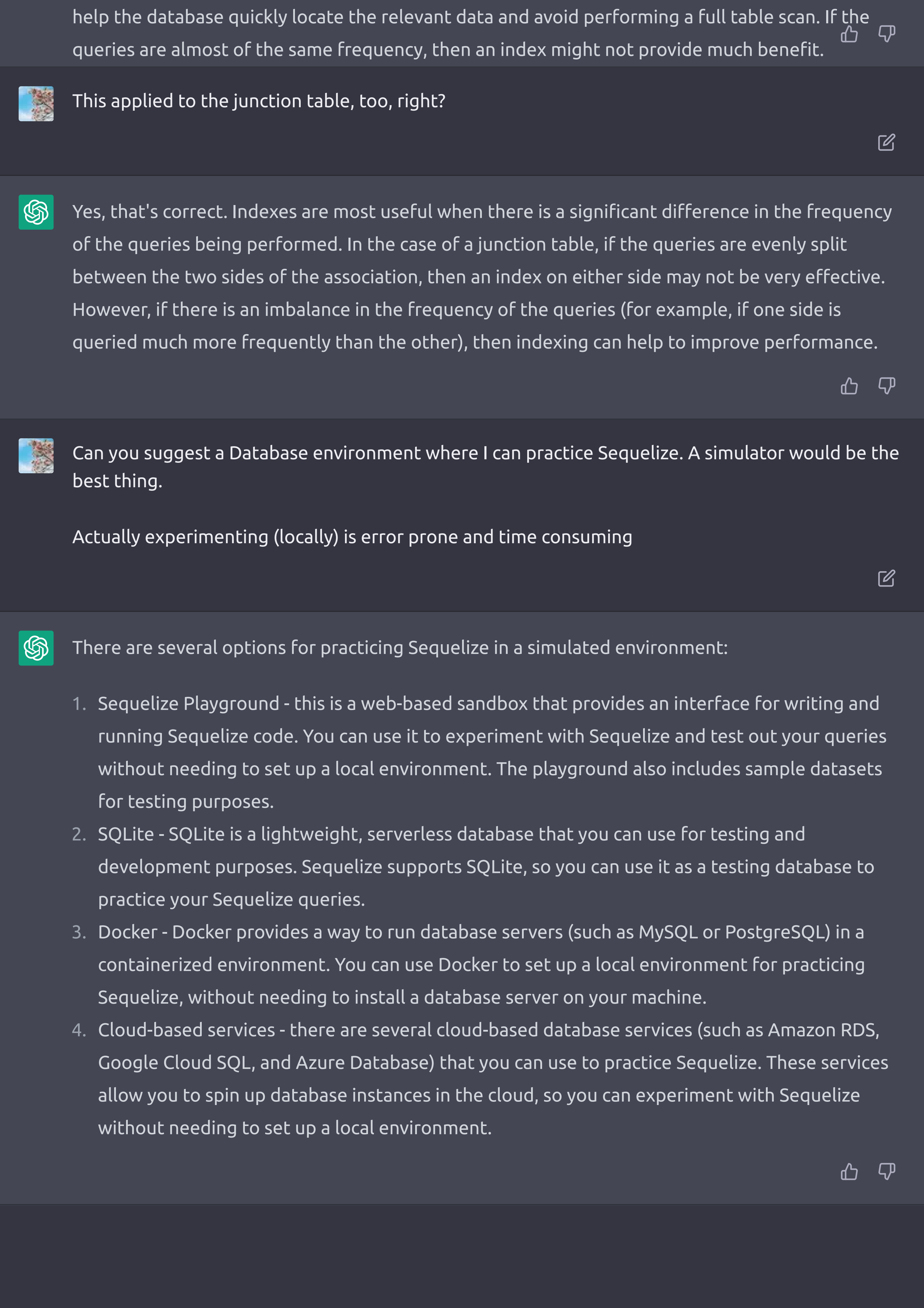
Using indexes on a junction table can be useful for improving performance of queries involving the junction table. For example, if you frequently query for all the groups that a user belongs to, creating an index on the `userId` column in the junction table can speed up these queries.

Similarly, if you frequently query for all the users that belong to a group, creating an index on the `groupId` column in the junction table can speed up these queries.

However, creating indexes on the columns of the junction table might not be as effective as creating indexes on the columns of the related tables, especially if the junction table has a large number of rows. In such cases, it might be more efficient to denormalize the data and add the relevant columns to the related tables themselves, and create indexes on those columns instead.

If queries are almost of the same frequency, then index will help less, right?
In other words, indexes are most efficient when there's an imbalance, right?

Yes, that's correct. Indexes are most efficient when there's an imbalance in the data, meaning that a smaller subset of the data is queried more frequently than the rest. In such cases, the index can



help the database quickly locate the relevant data and avoid performing a full table scan. If the queries are almost of the same frequency, then an index might not provide much benefit.

This applied to the junction table, too, right?

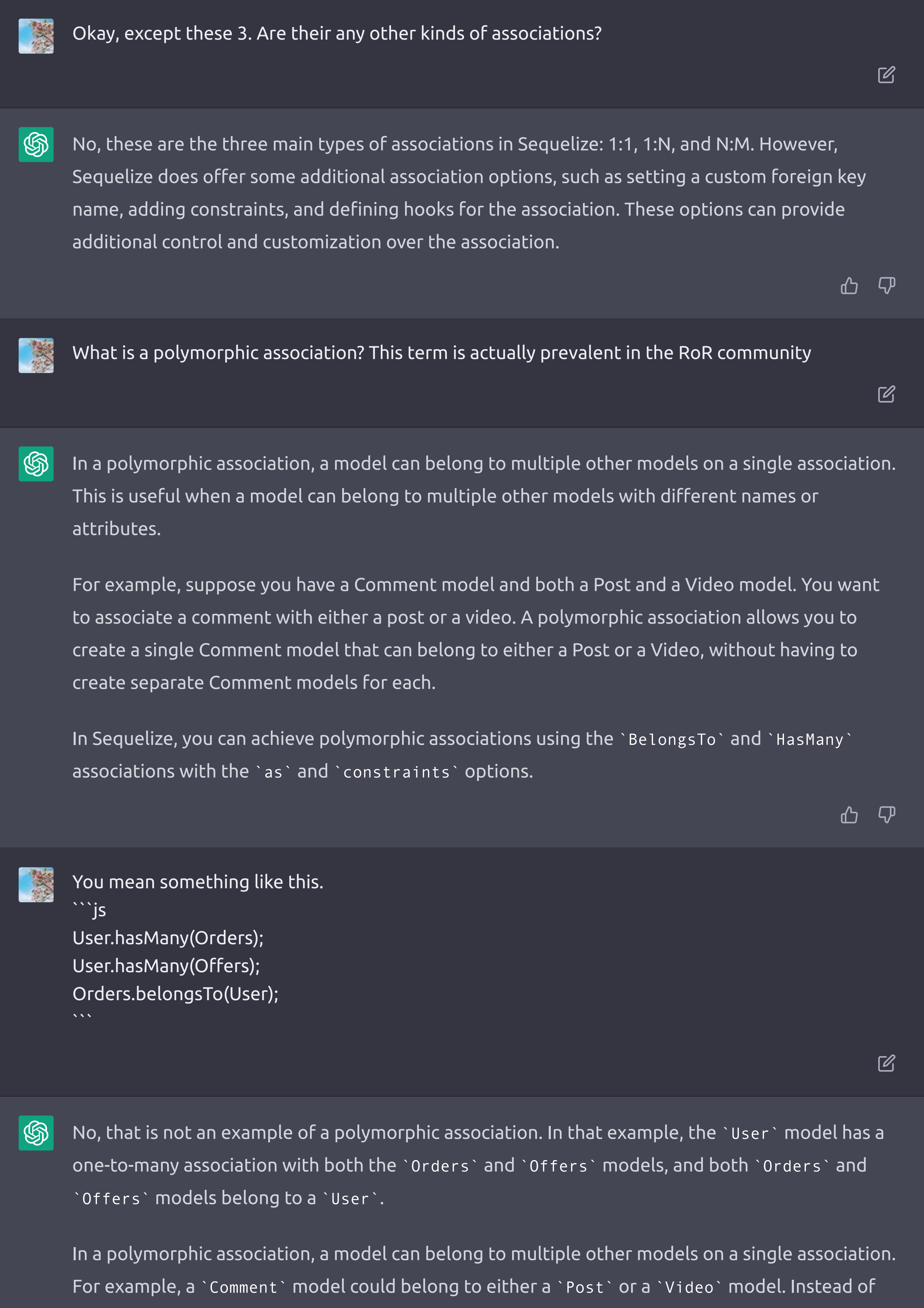
Yes, that's correct. Indexes are most useful when there is a significant difference in the frequency of the queries being performed. In the case of a junction table, if the queries are evenly split between the two sides of the association, then an index on either side may not be very effective. However, if there is an imbalance in the frequency of the queries (for example, if one side is queried much more frequently than the other), then indexing can help to improve performance.

Can you suggest a Database environment where I can practice Sequelize. A simulator would be the best thing.

Actually experimenting (locally) is error prone and time consuming

There are several options for practicing Sequelize in a simulated environment:

1. Sequelize Playground - this is a web-based sandbox that provides an interface for writing and running Sequelize code. You can use it to experiment with Sequelize and test out your queries without needing to set up a local environment. The playground also includes sample datasets for testing purposes.
2. SQLite - SQLite is a lightweight, serverless database that you can use for testing and development purposes. Sequelize supports SQLite, so you can use it as a testing database to practice your Sequelize queries.
3. Docker - Docker provides a way to run database servers (such as MySQL or PostgreSQL) in a containerized environment. You can use Docker to set up a local environment for practicing Sequelize, without needing to install a database server on your machine.
4. Cloud-based services - there are several cloud-based database services (such as Amazon RDS, Google Cloud SQL, and Azure Database) that you can use to practice Sequelize. These services allow you to spin up database instances in the cloud, so you can experiment with Sequelize without needing to set up a local environment.



Okay, except these 3. Are their any other kinds of associations?

No, these are the three main types of associations in Sequelize: 1:1, 1:N, and N:M. However, Sequelize does offer some additional association options, such as setting a custom foreign key name, adding constraints, and defining hooks for the association. These options can provide additional control and customization over the association.

What is a polymorphic association? This term is actually prevalent in the RoR community

In a polymorphic association, a model can belong to multiple other models on a single association. This is useful when a model can belong to multiple other models with different names or attributes.

For example, suppose you have a Comment model and both a Post and a Video model. You want to associate a comment with either a post or a video. A polymorphic association allows you to create a single Comment model that can belong to either a Post or a Video, without having to create separate Comment models for each.

In Sequelize, you can achieve polymorphic associations using the `BelongsTo` and `HasMany` associations with the `as` and `constraints` options.

You mean something like this.

```js
User.hasMany(Orders);
User.hasMany(Offers);
Orders.belongsTo(User);
```

No, that is not an example of a polymorphic association. In that example, the `User` model has a one-to-many association with both the `Orders` and `Offers` models, and both `Orders` and `Offers` models belong to a `User`.

In a polymorphic association, a model can belong to multiple other models on a single association. For example, a `Comment` model could belong to either a `Post` or a `Video` model. Instead of having separate `CommentOnPost` and `CommentOnVideo` models, you could use a polymorphic association to handle both cases with a single `Comment` model.

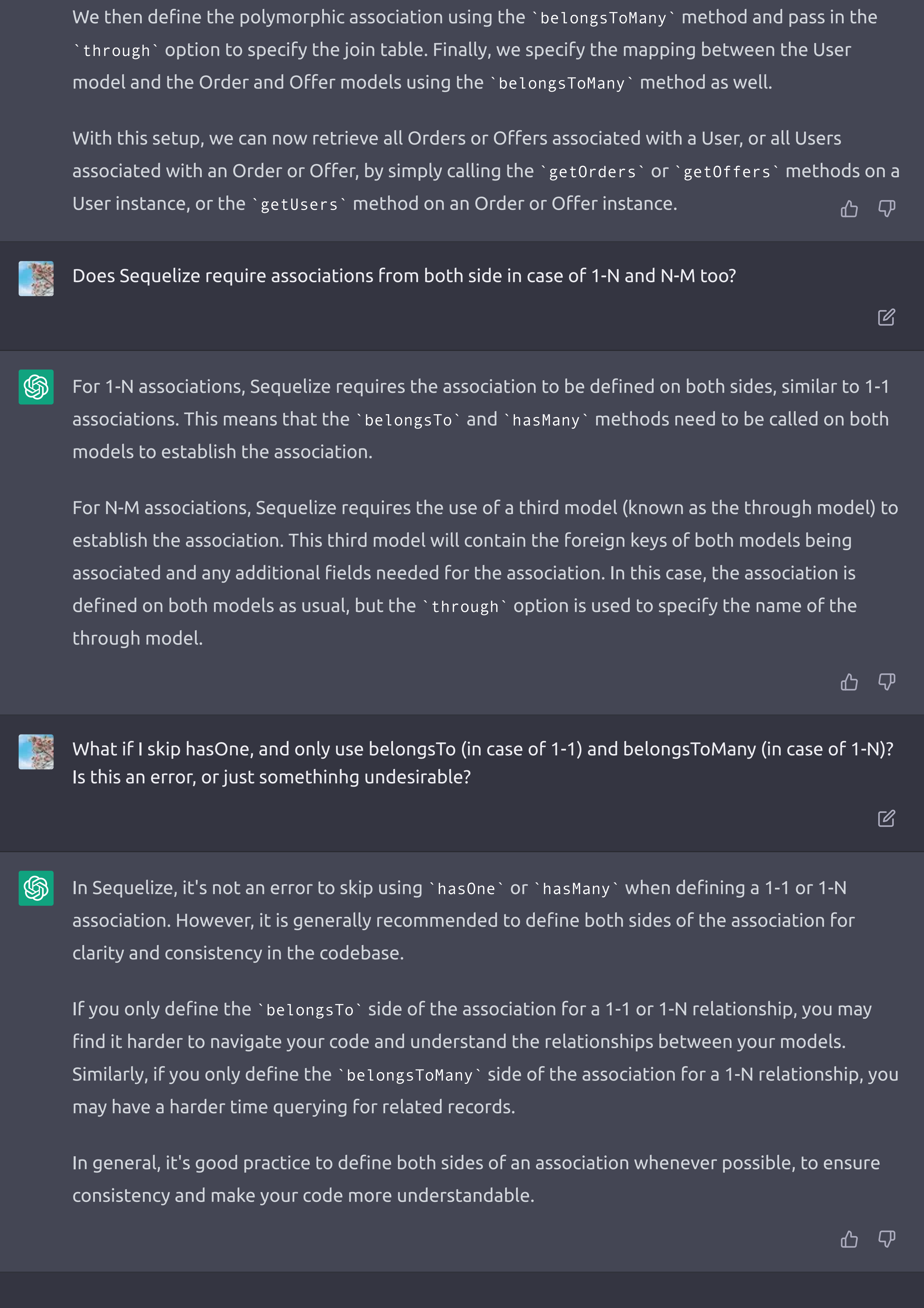
Code example

Sure, here's an example of a polymorphic association in Sequelize:

js

```js
const User = sequelize.define('user', {
  name: DataTypes.STRING
});

const Order = sequelize.define('order', {
  quantity: DataTypes.INTEGER
});

const Offer = sequelize.define('offer', {
  price: DataTypes.INTEGER
});

const OrderOffer = sequelize.define('orderOffer', {
  // Here we define the polymorphic association key
  // which will be used to map the related records
  relatedType: {
    type: DataTypes.ENUM('order', 'offer'),
    allowNull: false
  }
});

// Define the polymorphic association
Order.belongsToMany(User, { through: OrderOffer });
Offer.belongsToMany(User, { through: OrderOffer });
User.belongsToMany(Order, { through: OrderOffer });
User.belongsToMany(Offer, { through: OrderOffer });
```

In this example, we have three models: User, Order, and Offer. We also have a join table called OrderOffer which contains a polymorphic association key called `relatedType`. This key is used to map the related records between the Order and Offer models and the User model.



We then define the polymorphic association using the `belongsToMany` method and pass in the `through` option to specify the join table. Finally, we specify the mapping between the User model and the Order and Offer models using the `belongsToMany` method as well.

With this setup, we can now retrieve all Orders or Offers associated with a User, or all Users associated with an Order or Offer, by simply calling the `getOrders` or `getOffers` methods on a User instance, or the `getUsers` method on an Order or Offer instance.

Does Sequelize require associations from both side in case of 1-N and N-M too?

For 1-N associations, Sequelize requires the association to be defined on both sides, similar to 1-1 associations. This means that the `belongsTo` and `hasMany` methods need to be called on both models to establish the association.

For N-M associations, Sequelize requires the use of a third model (known as the through model) to establish the association. This third model will contain the foreign keys of both models being associated and any additional fields needed for the association. In this case, the association is defined on both models as usual, but the `through` option is used to specify the name of the through model.

What if I skip hasOne, and only use belongsTo (in case of 1-1) and belongsToMany (in case of 1-N)? Is this an error, or just somethinhg undesirable?

In Sequelize, it's not an error to skip using `hasOne` or `hasMany` when defining a 1-1 or 1-N association. However, it is generally recommended to define both sides of the association for clarity and consistency in the codebase.

If you only define the `belongsTo` side of the association for a 1-1 or 1-N relationship, you may find it harder to navigate your code and understand the relationships between your models. Similarly, if you only define the `belongsToMany` side of the association for a 1-N relationship, you may have a harder time querying for related records.

In general, it's good practice to define both sides of an association whenever possible, to ensure consistency and make your code more understandable.

Okay.

Is there anything else you would like to know about Sequelize?

Clarify: polymorphic associations are ones that have more than 2 columns in the junction table?

No, that's not correct. Polymorphic associations are a type of association where a model can belong to multiple other models on a single association. It's called "polymorphic" because the association can be associated with multiple models, which means the associated model can "morph" into different types. In other words, it's a single association that can be used across multiple models, instead of having a separate association for each related model.

For example, a Comment model could belong to either a Post or a Video model. To represent this in Sequelize, we can use a polymorphic association like this:

```js
Comment.belongsTo(Post);
Comment.belongsTo(Video);
Post.hasMany(Comment);
Video.hasMany(Comment);
```

Here, the `Comment` model belongs to either a `Post` or a `Video`, depending on the context. This is represented by having two separate `belongsTo` associations on the `Comment` model, one for `Post` and one for `Video`. The `Post` and `Video` models both have a `hasMany` association with the `Comment` model.

Is it possible to avoid polymporphic relatios, by using some alternate pattern?

It is possible to avoid polymorphic relations by using a separate association table for each related model. For example, instead of using a polymorphic association table `Likes`, you could create separate association tables like `UserLikes` and `PostLikes`. This approach allows you to avoid the complexity of polymorphic associations and can also provide better performance since each association table is optimized for its specific use case. However, it can result in more tables being

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