Bringing Photoshop to the iPad

Sean Parent | Senior Principal Scientist

#AdobeRemix
Vasjen Katro / Baugasm

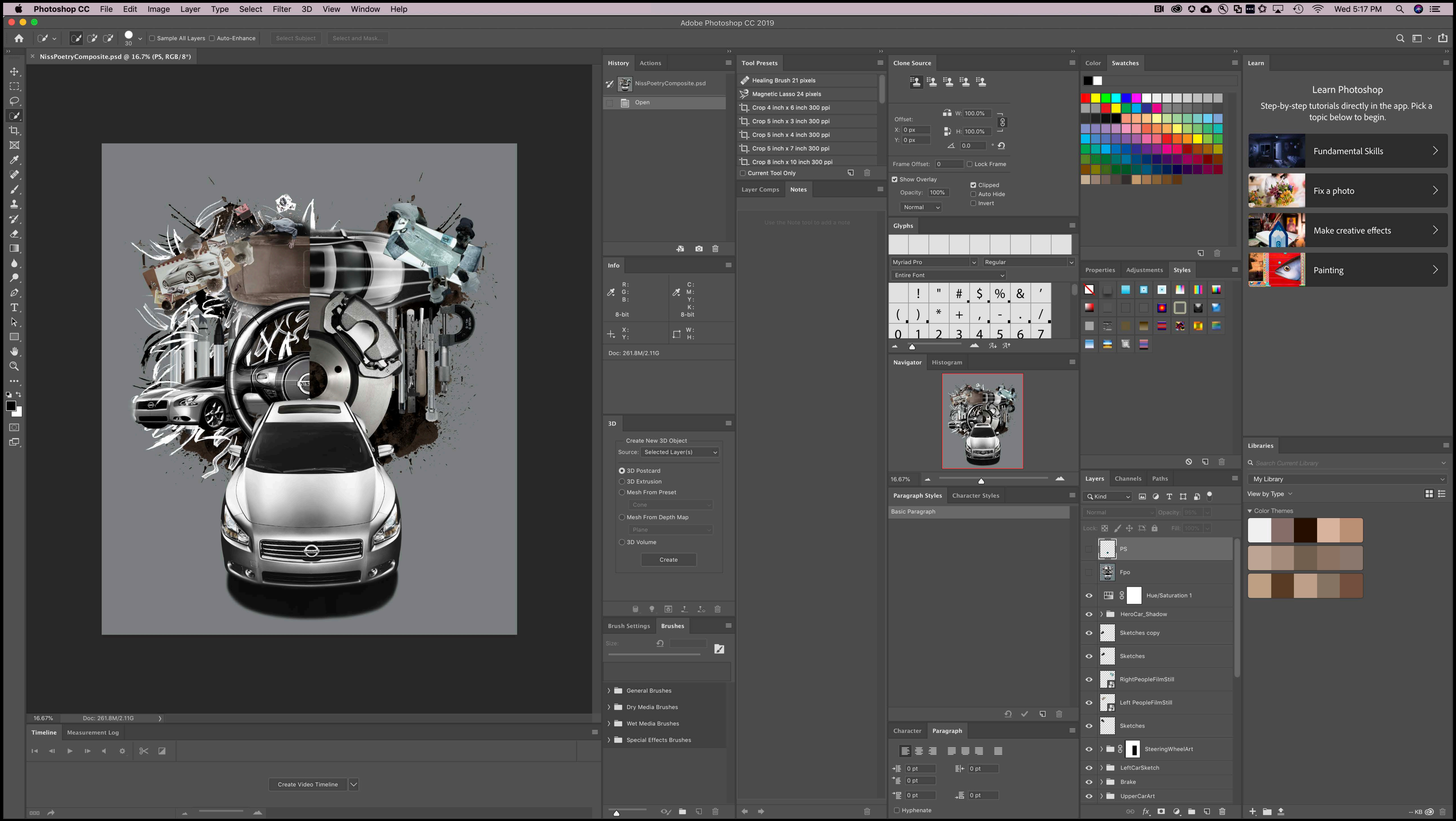
photoshopishiring.com

"Could we just put Photoshop on the iPad?"

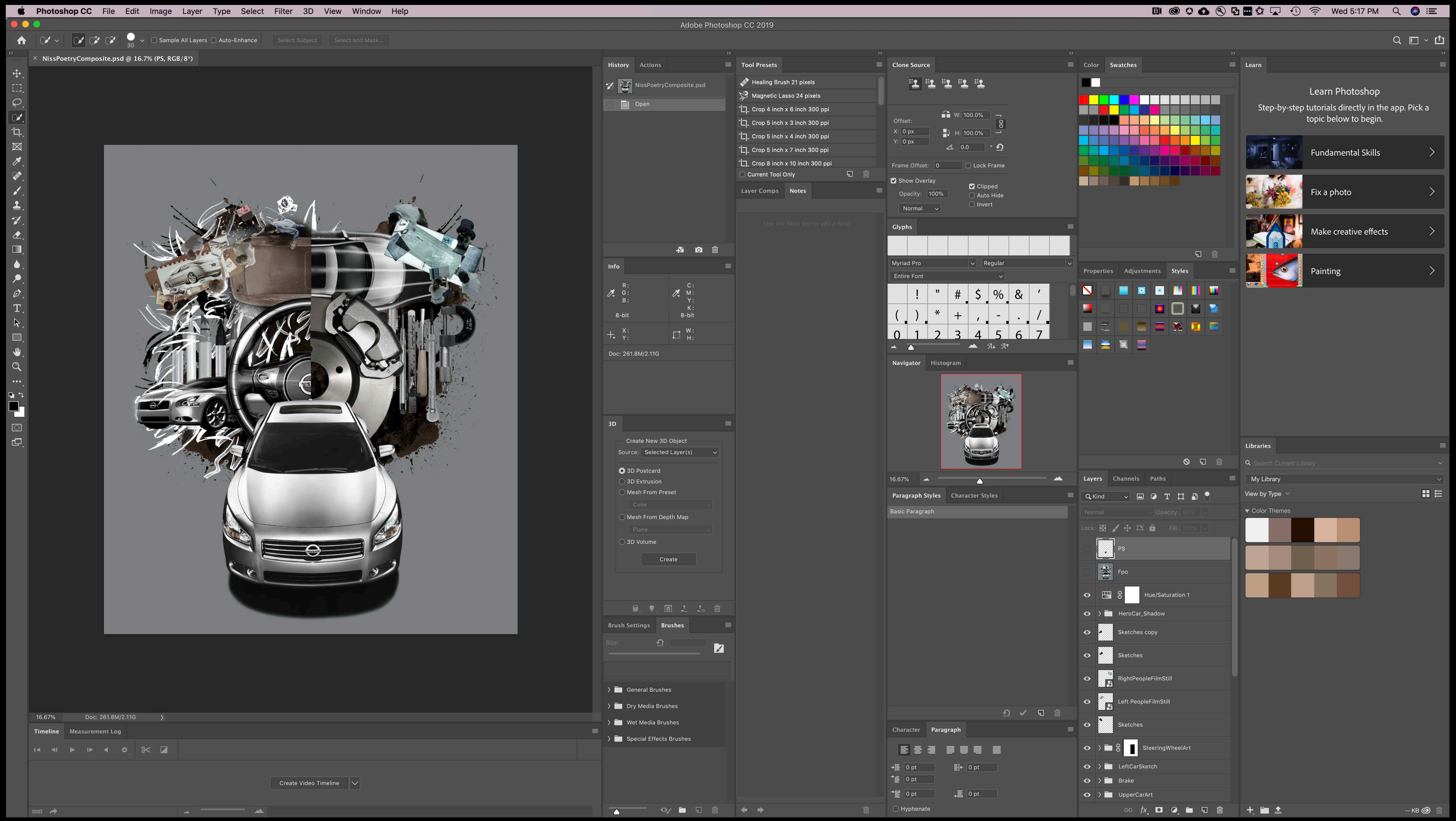
– David Howe

Adobe

Demo


Photoshop CC File Edit Image Layer Type Select Filter 3D View Window Help
Wed 5:17 PM
Adobe Photoshop CC 2019
Sample All Layers
Auto-Enhance
Select Subject
Select and Mask...
NissPoetryComposite.psd @ 16.7% (PS, RGB/8*)
History
Actions
Open
Tool Presets
Healing Brush 21 pixels
Magnetic Lasso 24 pixels
Crop 4 inch x 6 inch 300 ppi
Crop 5 inch x 3 inch 300 ppi
Crop 5 inch x 4 inch 300 ppi
Crop 5 inch x 7 inch 300 ppi
Crop 8 inch x 10 inch 300 ppi
Current Tool Only
Clone Source
Color
Swatches
Learn
Learn Photoshop
Step-by-step tutorials directly in the app. Pick a topic below to begin.
Fundamental Skills
Fix a photo
Make creative effects
Painting
Layer Comps
Notes
Glyphs
Info
Doc: 261.8M/2.11G
Properties
Adjustments
Styles
Navigator
Histogram
16.67%
3D
Create New 3D Object
3D Postcard
3D Extrusion
Mesh From Preset
Mesh From Depth Map
3D Volume
Create
Paragraph Styles
Character Styles
Basic Paragraph
Layers
Channels
Paths
Libraries
My Library
View by Type
Color Themes
PS
Fpo
Hue/Saturation 1
HeroCar_Shadow
Sketches copy
Sketches
RightPeopleFilmStill
Left PeopleFilmStill
Sketches
SteeringWheelArt
LeftCarSketch
Brake
UpperCarArt
Brush Settings
Brushes
General Brushes
Dry Media Brushes
Wet Media Brushes
Special Effects Brushes
Timeline
Measurement Log
Create Video Timeline
Character
Paragraph
Hyphenate

Challenge: Photoshop is Complex



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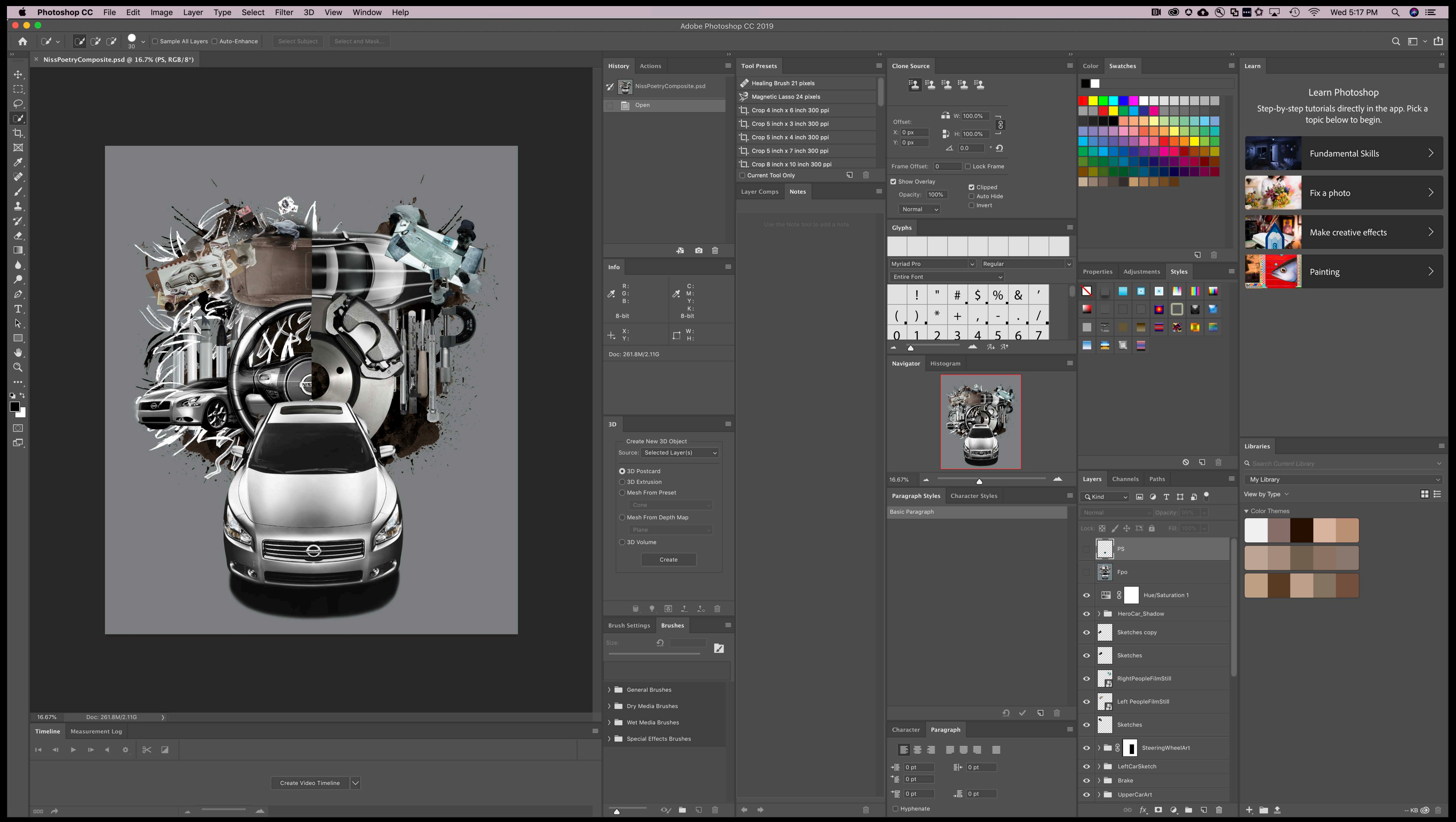

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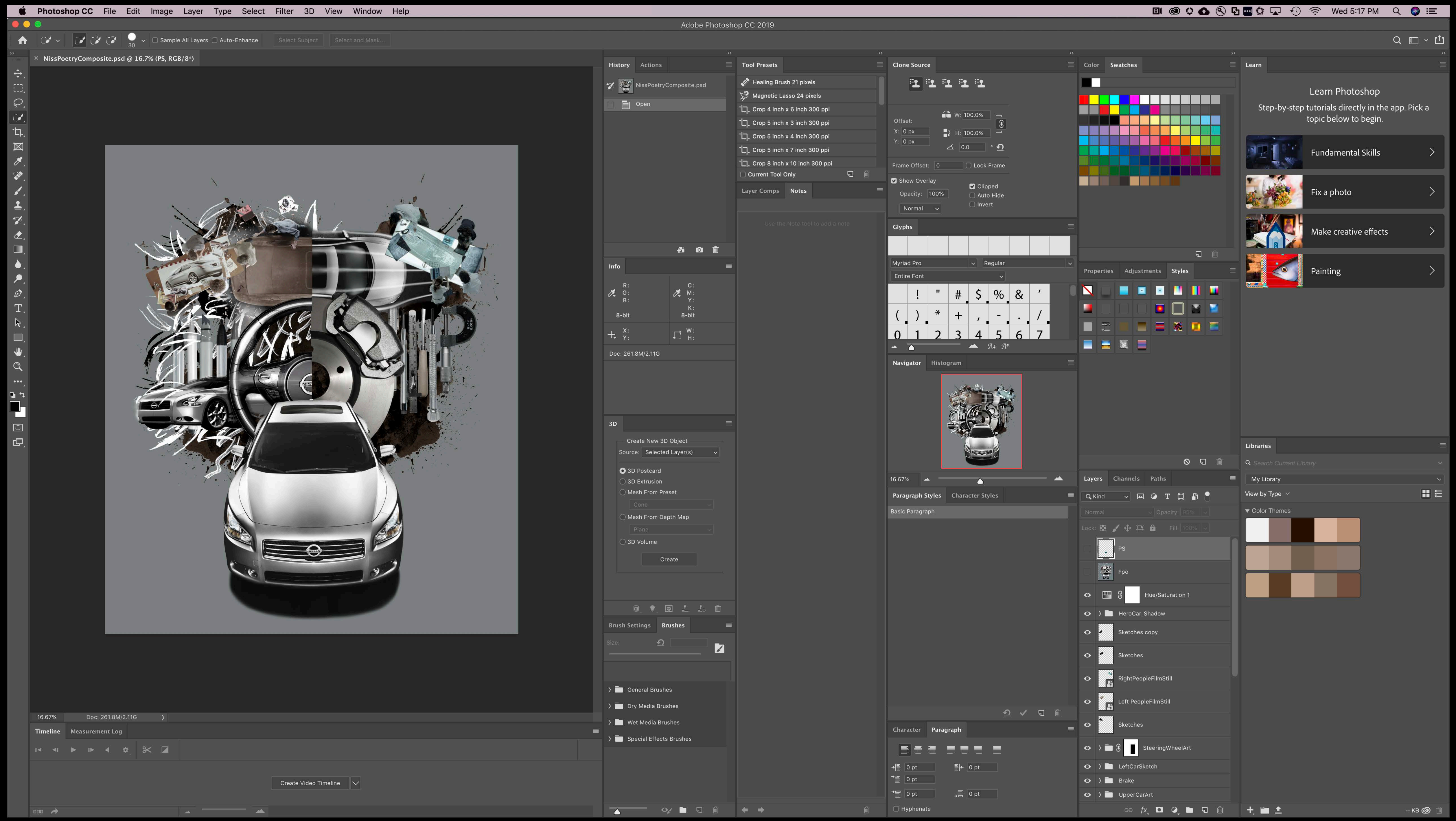

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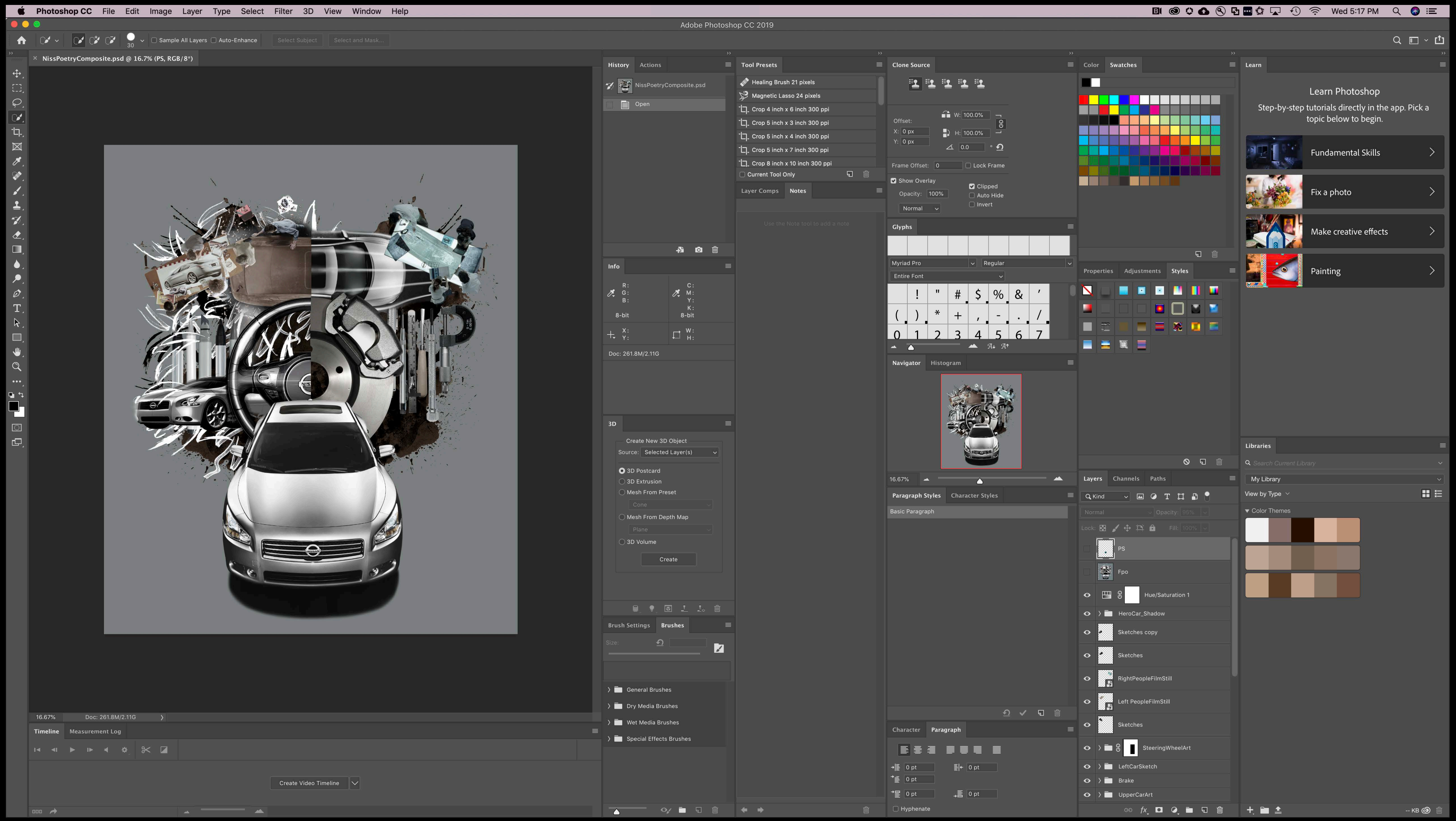

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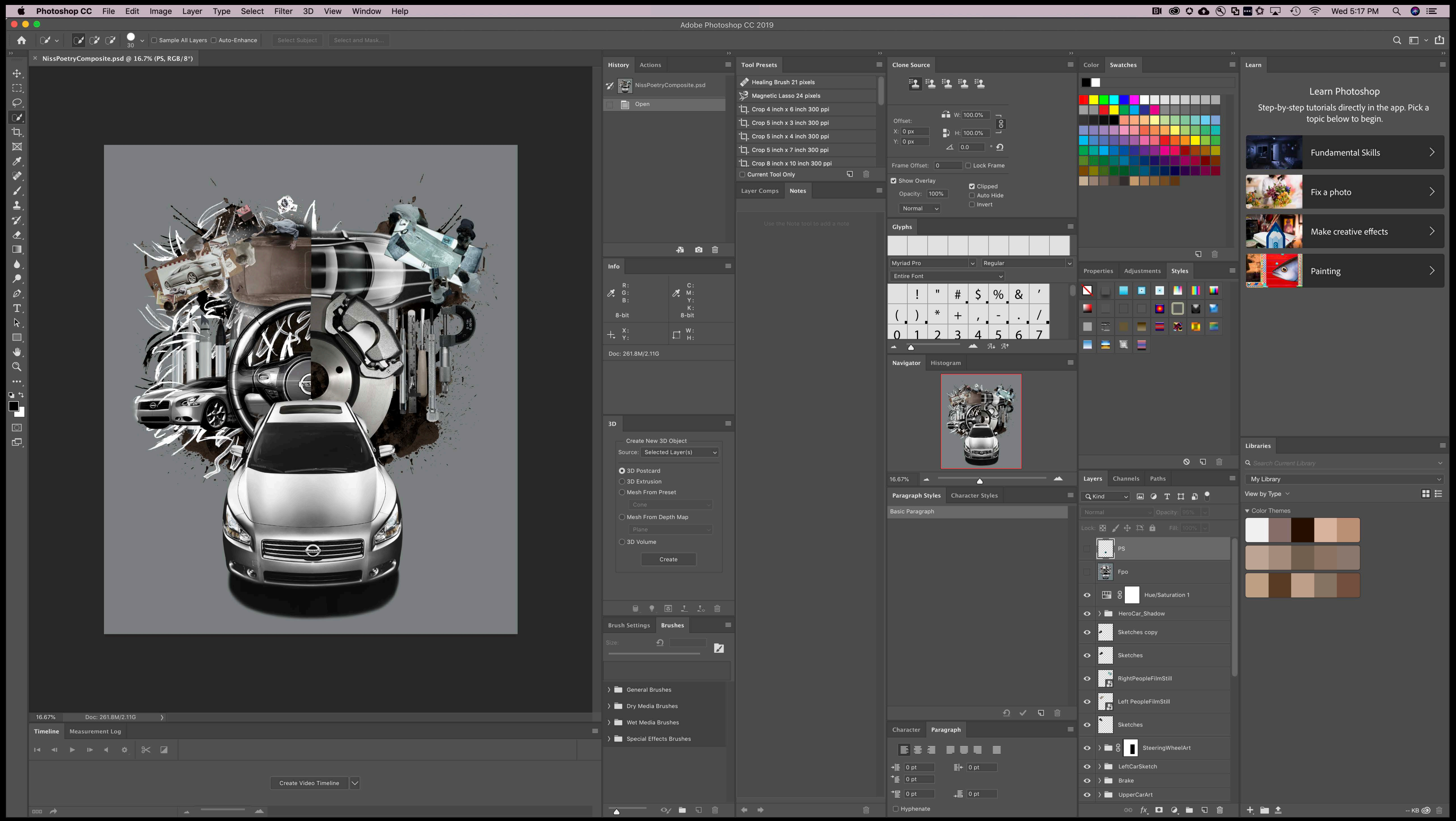

Challenge: Photoshop is Complex

- There is no explicit model
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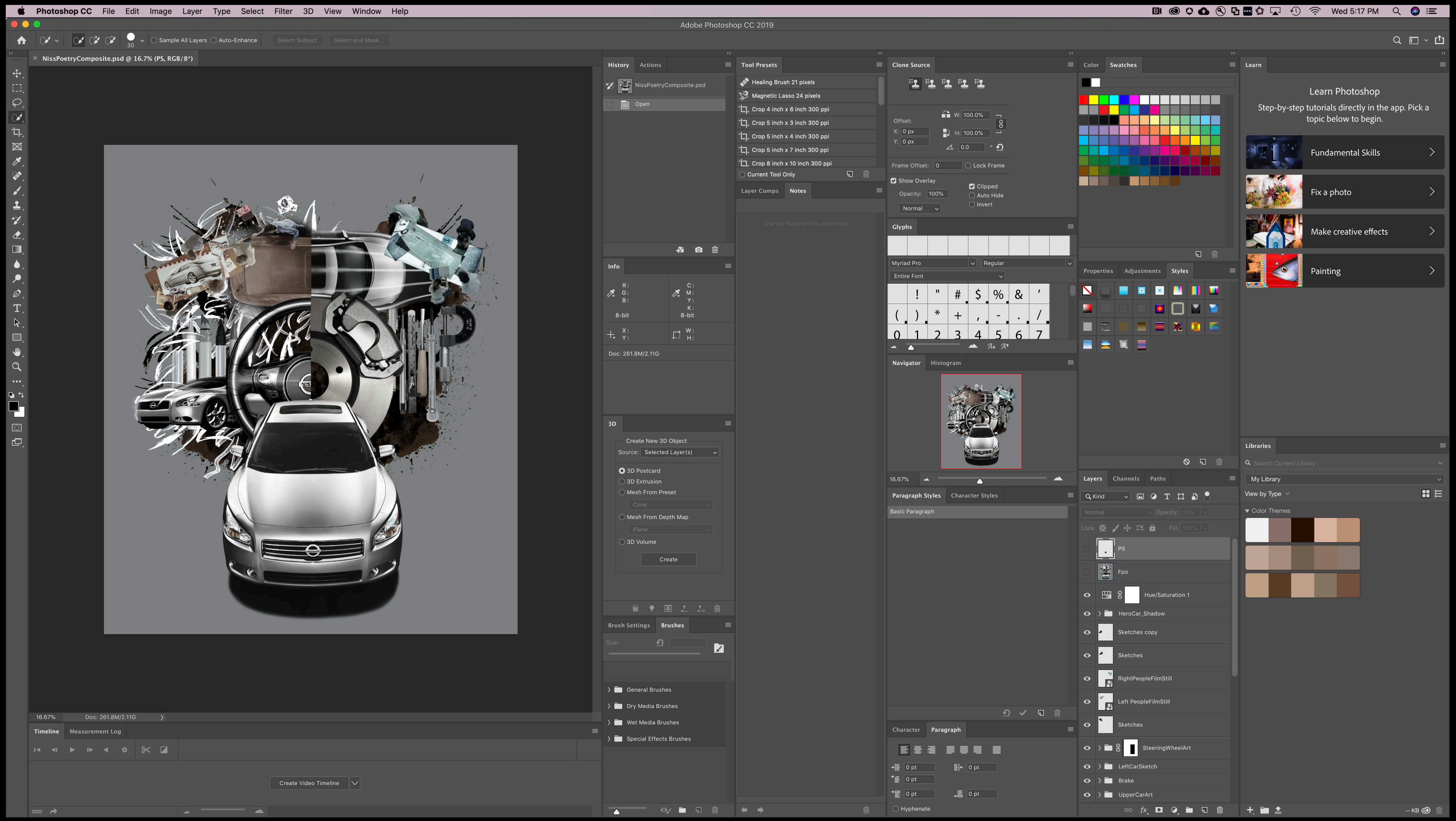
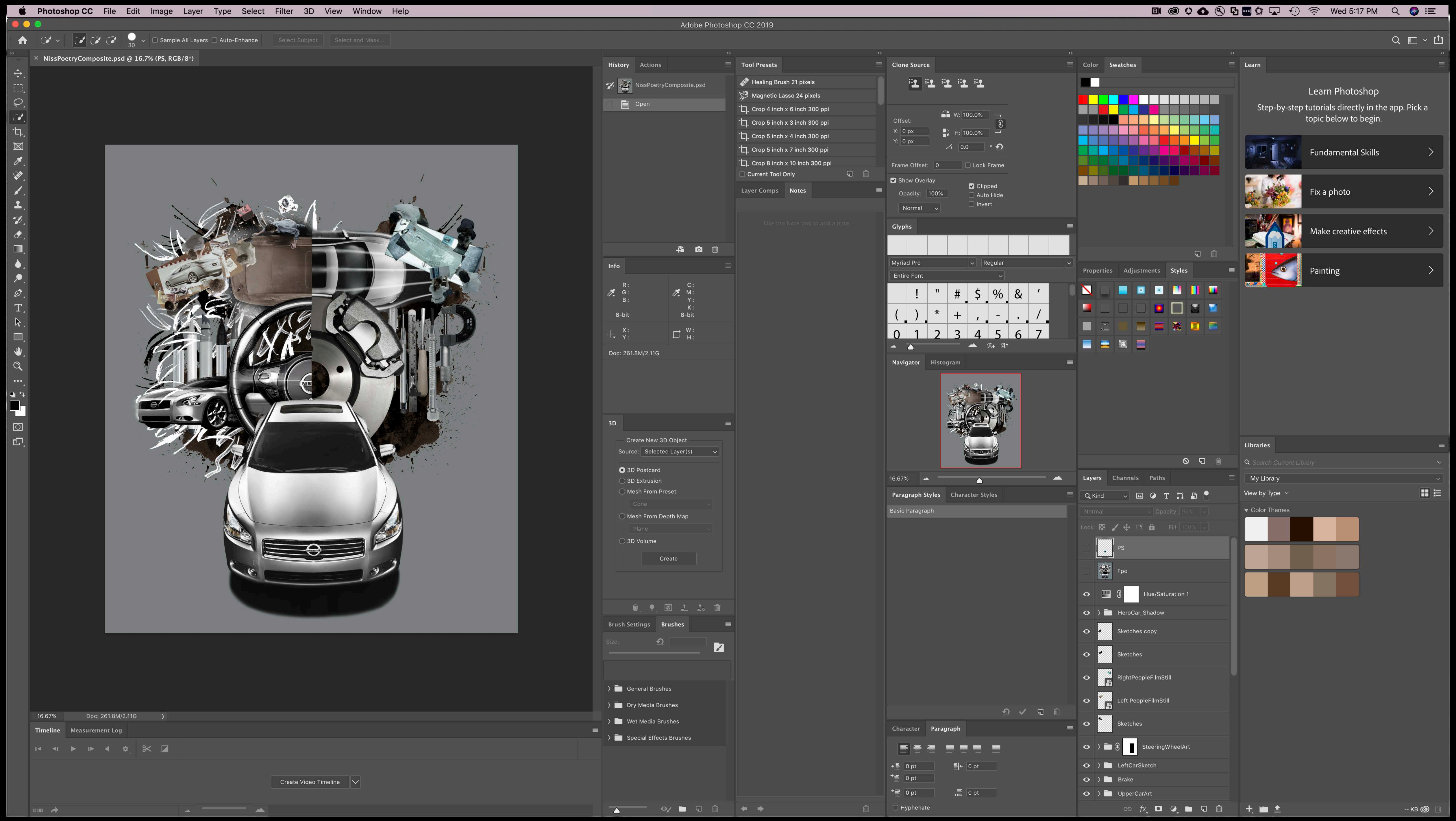
    - Observable



The UI *is* the Model

Solution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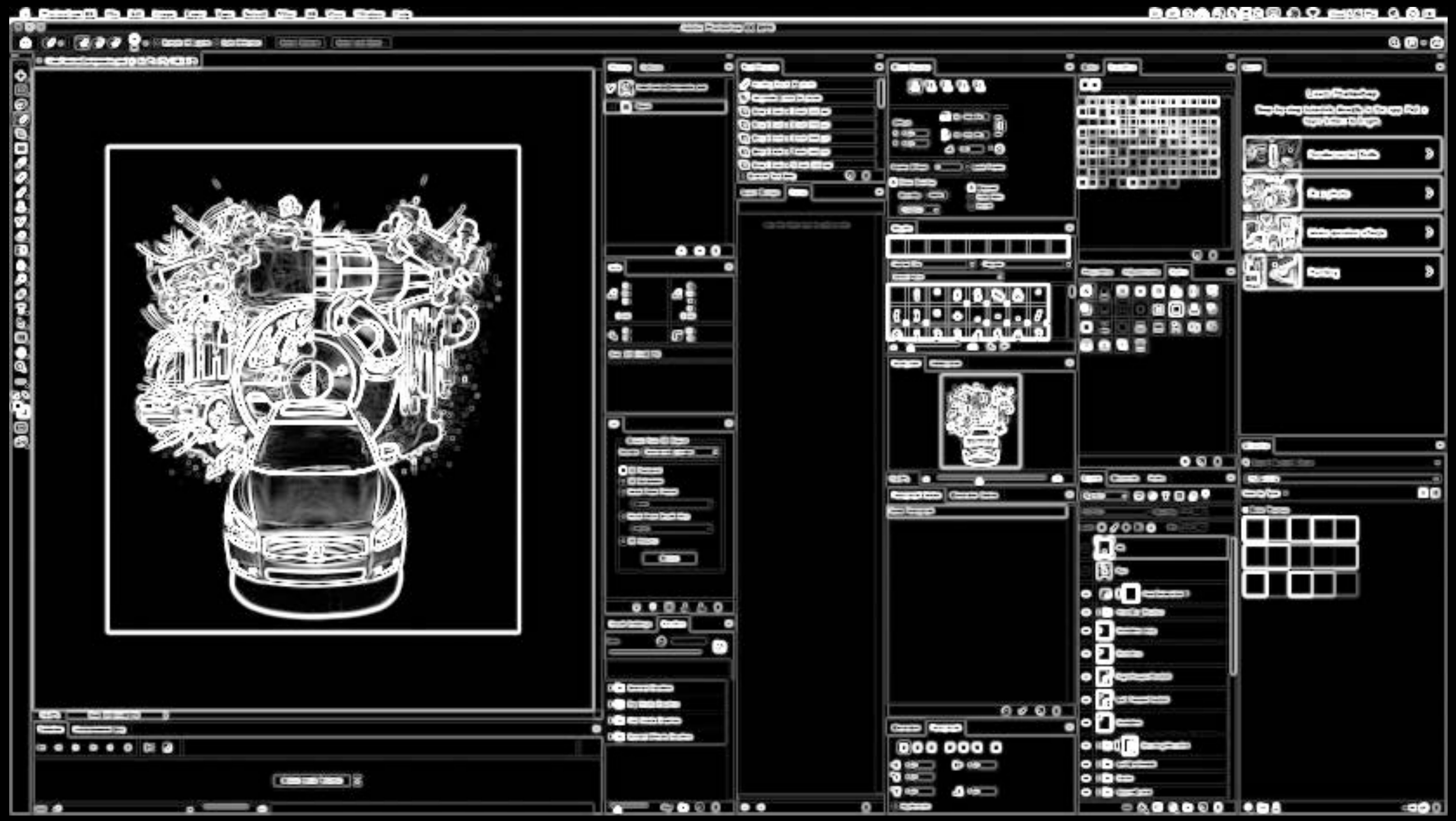

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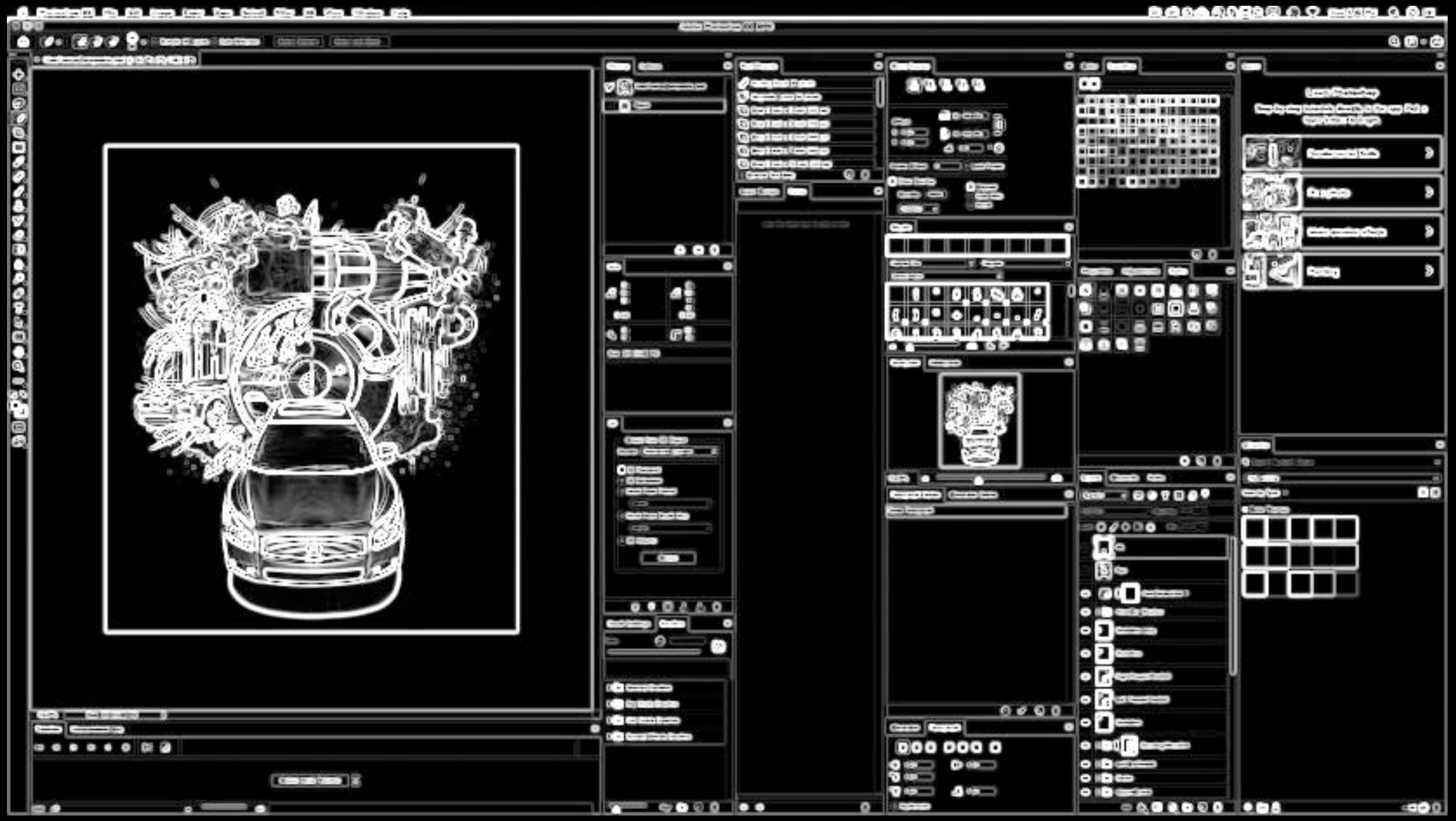

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- Lazily instantiate UI elements as needed

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Adobe

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  - User Input Interleaved with Rendering

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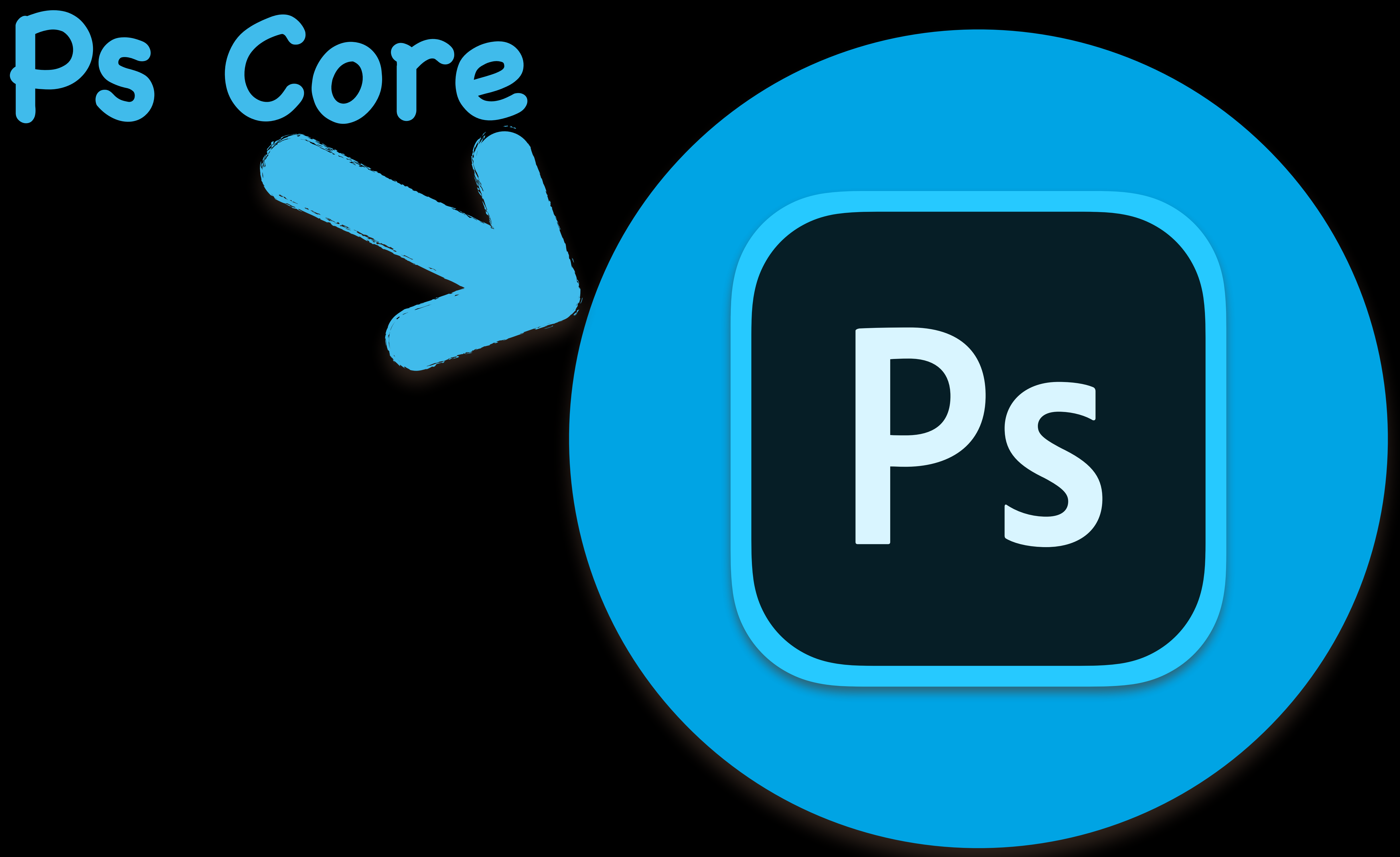

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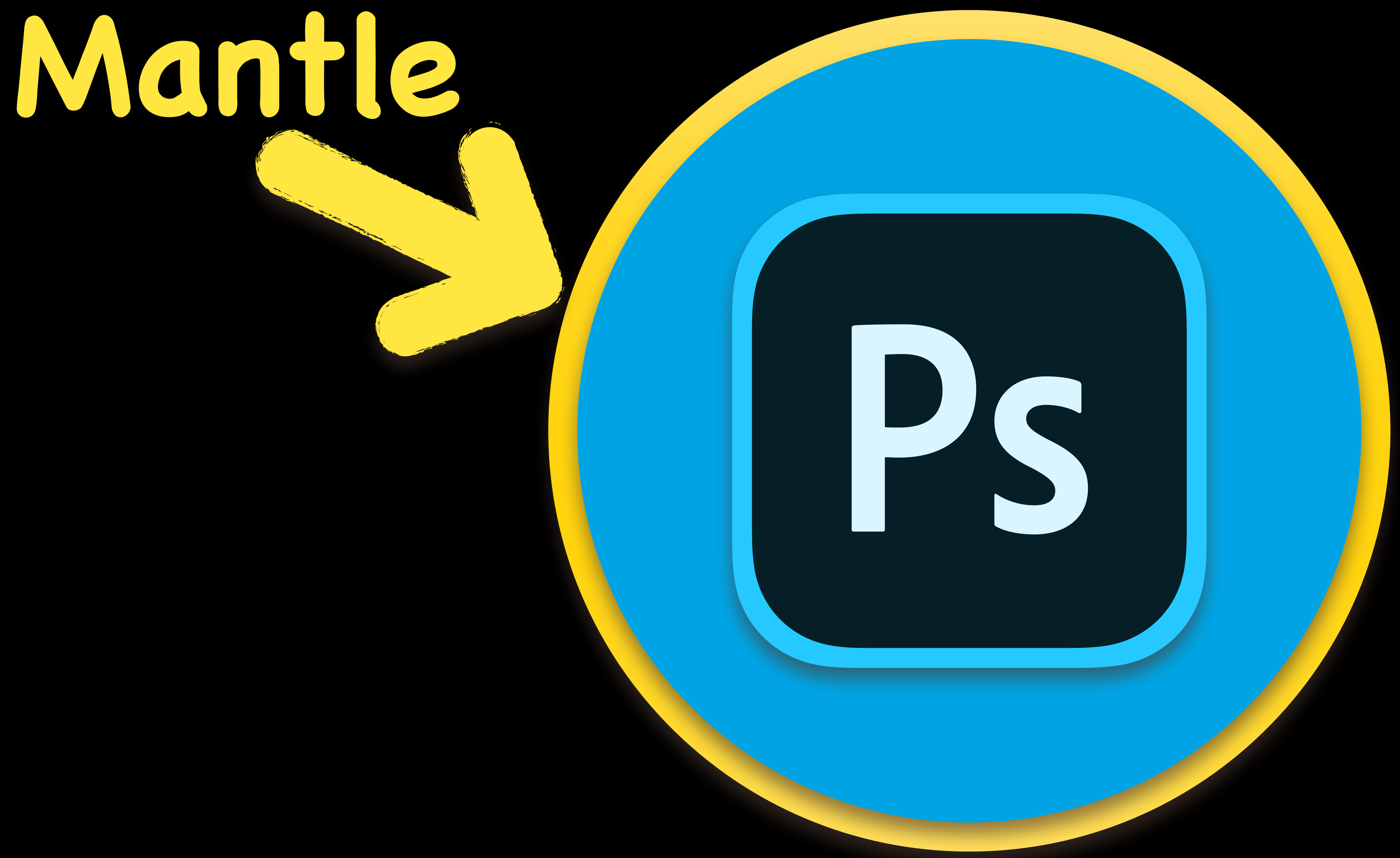

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    - connectable (slot & signal)
    - auto disconnect on object expiration

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  - Programmer's view (and user view) is instantaneous
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- Each property change message from mantle to core is associated the transaction count
- The transaction id is stored in a thread-local scope
  - Globally available to any notifiers
- Notifications from core to mantle echo back the count
  - If a mantle property receives an update with a count less than the property count, the update is ignored

Transactions

```cpp
class transaction {
public:
    enum class id_t : std::size_t { initial = 0, none = std::numeric_limits<std::size_t>::max() };

    transaction(id_t id) : _prior{current()} { current() = id; }

    ~transaction() { current() = _prior; }

    static id_t next() {
        static std::atomic<std::size_t> id{0};
        return static_cast<id_t>(++id);
    }

    static id_t& current() {
        thread_local id_t id{id_t::none};
        return id;
    }

private:
    id_t _prior;
};
```

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- Upon an initial event a coroutine is created and sent to be processed on core
- A direct communication channel is established from sender to coroutine
- Subsequent messages are sent direct to the coroutine

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- Strategy is time based to maintain frame rate
  - Not user event based (such as finger up/down)

```cpp
template <class, class, class>
class latest;

template <class Executor, class Task, class... Args>
class latest<Executor, Task, void(Args...)> {

    struct receiver {
        Task _task;
        std::mutex _mutex;
        bool _queued{false}; // is a task queued already
        std::optional<std::tuple<Args...>> _value; // message value

        template <class F>
        explicit receiver(F&& f) : _task(std::forward<F>(f)) {}

        template <class... T>
        bool send(T&&... arg) {
            bool queued = true;
            std::unique_lock<std::mutex> lock(_mutex);
            _value = std::make_tuple(std::forward<T>(arg)...);
            std::swap(queued, _queued);
            return queued;
        }

        void invoke() {
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            value = std::move(_value.get());
        }
        std::apply(_task, std::move(value));
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};

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```cpp
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    Executor _executor;
    std::shared_ptr<receiver> _shared;

public:
    template <class T, class F>
    latest(T&& executor, F&& task)
        : _executor{std::forward<T>(executor)}, _shared{std::make_shared<receiver>(
                                                    std::forward<F>(task))} {}

    template <class... T>
    void operator()(T&&... arg) const {
        if (!_shared->send(std::forward<T>(arg)...)) {
            _executor([_shared = _shared] { _shared->invoke(); });
        }
    }
};

template <class T, class Executor, class Task>
inline auto make_latest(Executor&& executor, Task&& task) {
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    template <class... T>
    void operator()(T&&... arg) const {
        if (!_shared->send(std::forward<T>(arg)...)) {
            _executor([_shared = _shared] { _shared->invoke(); });
        }
    }
};

template <class T, class Executor, class Task>
inline auto make_latest(Executor&& executor, Task&& task) {
    return latest<Executor, Task, T>{std::forward<Executor>(executor), std::forward<Task>(task)};
}
```

High Frequency Channels

```
auto f = make_latest<void(int)>(serial_queue, [](int x) { cout << x << '\n'; });

for (int n = 0; n != 3000; ++n) {
    f(n);
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470
1066
1143
1347
1454
1507
1698
1930
2219
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Mantle

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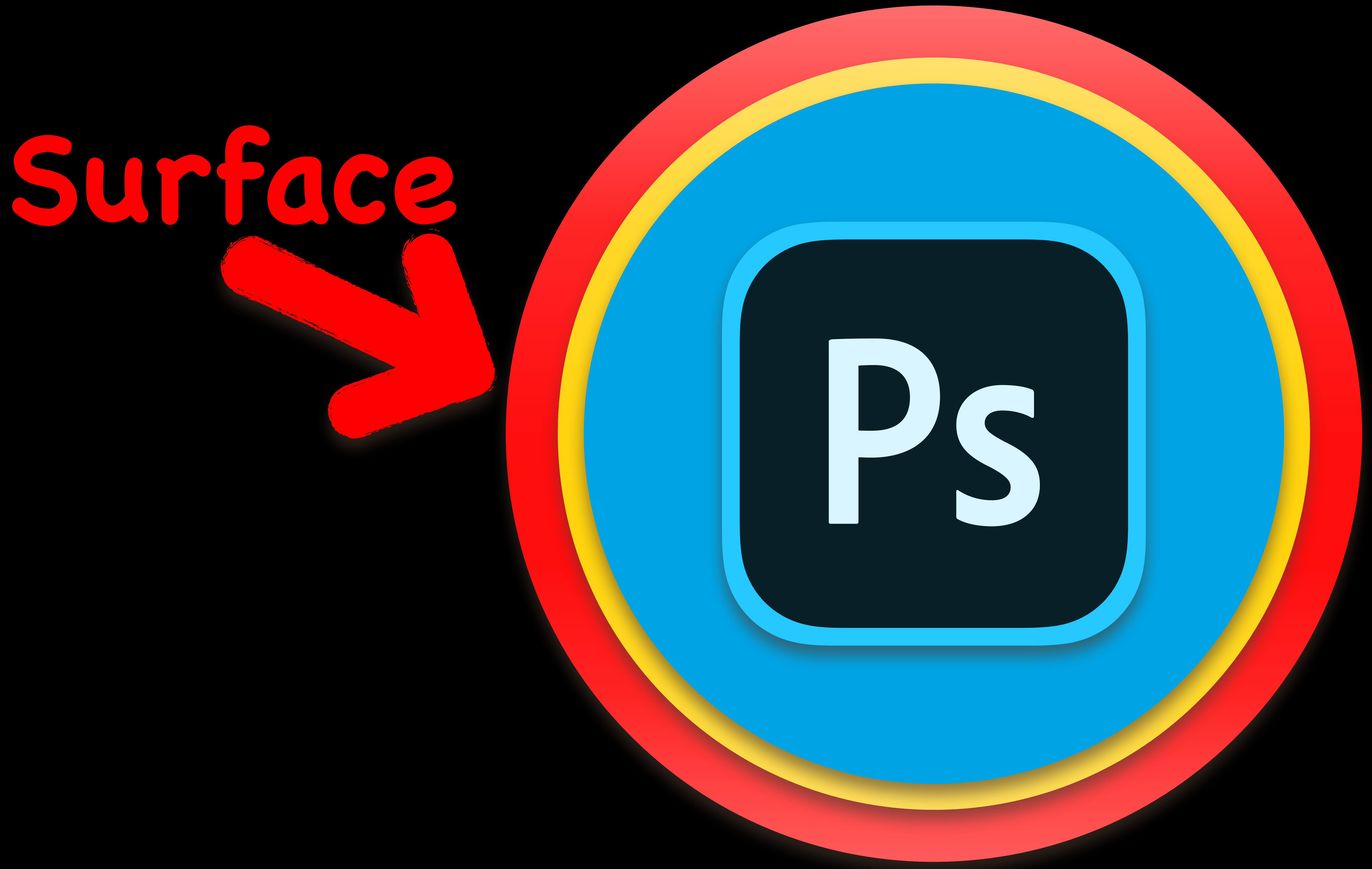
Mantle

- All communication with client on client thread
- The core and mantle are packaged as a library

Surface

Surface

- The *Surface* is a new, thin, UI



Surface

- The *Surface* is a new, thin, UI
  - Binds to the Mantle

Surface

- The *Surface* is a new, thin, UI
  - Binds to the Mantle
  - Model behaviors driven by the Core

Display System

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- Canvas display consists of two layer

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Display System

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  - Background is screen resolution of entire document
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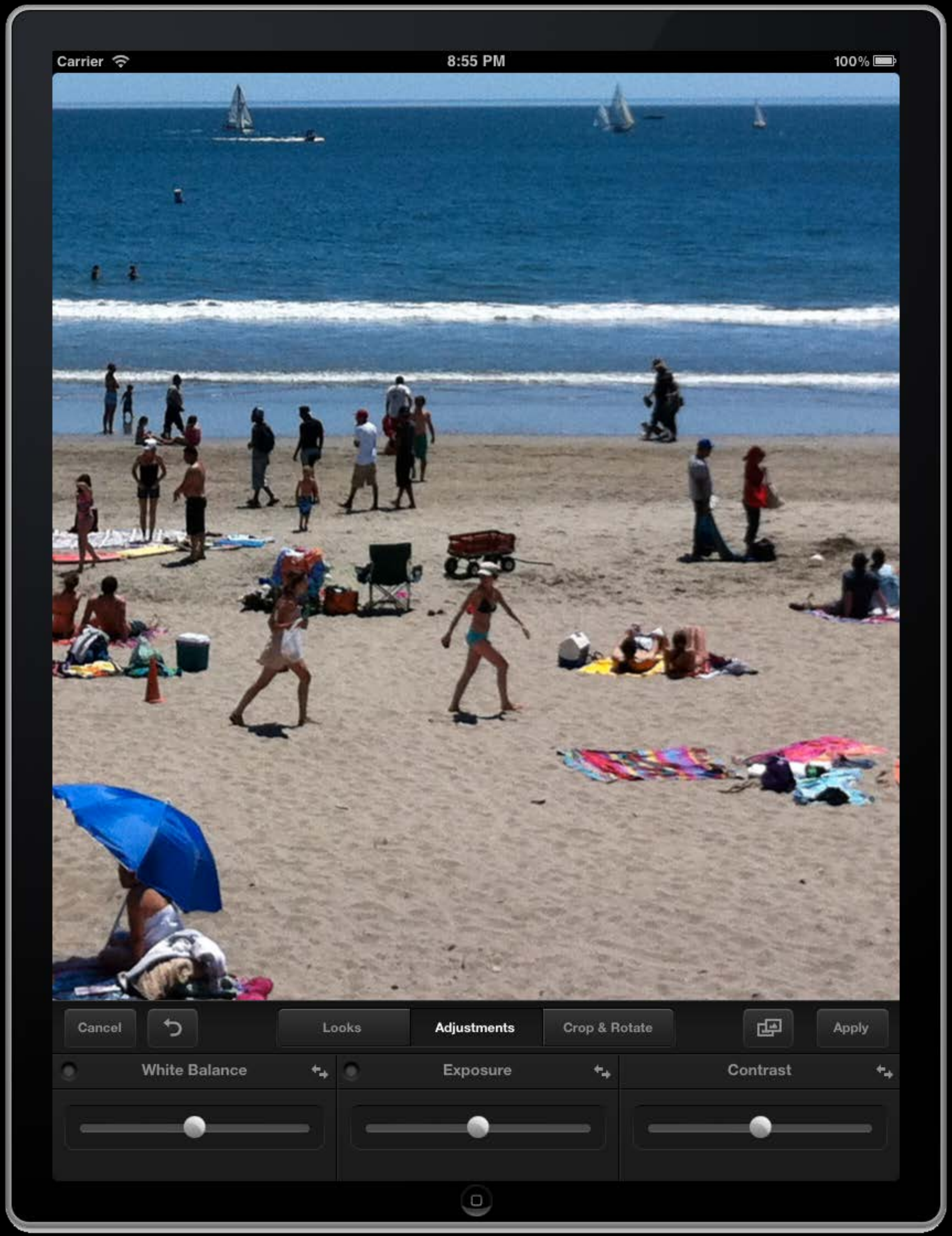
- *Resolution may be adapted to maintain frame rate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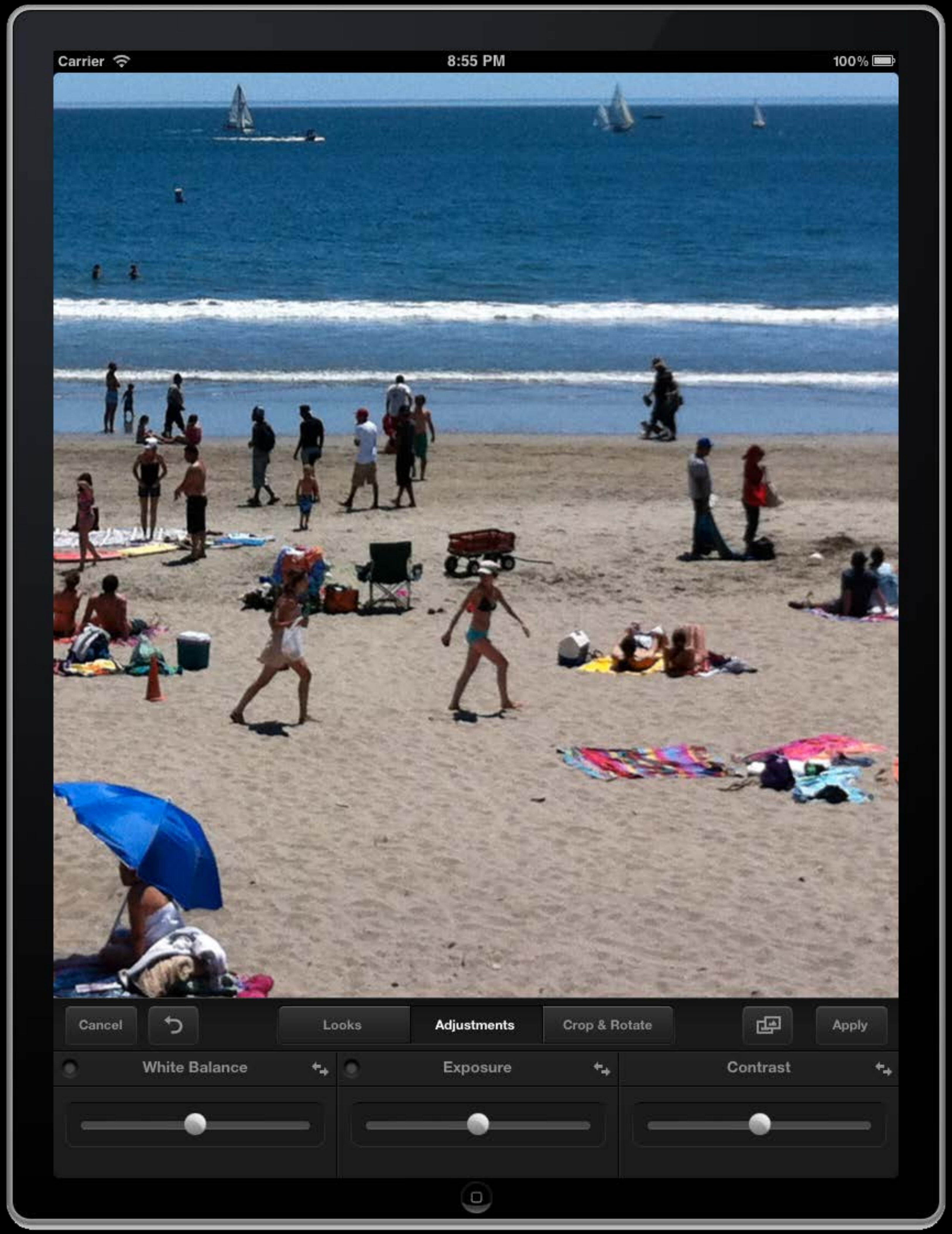
Cancel
Looks
Adjustments
Crop & Rotate
Apply
White Balance
Exposure
Contrast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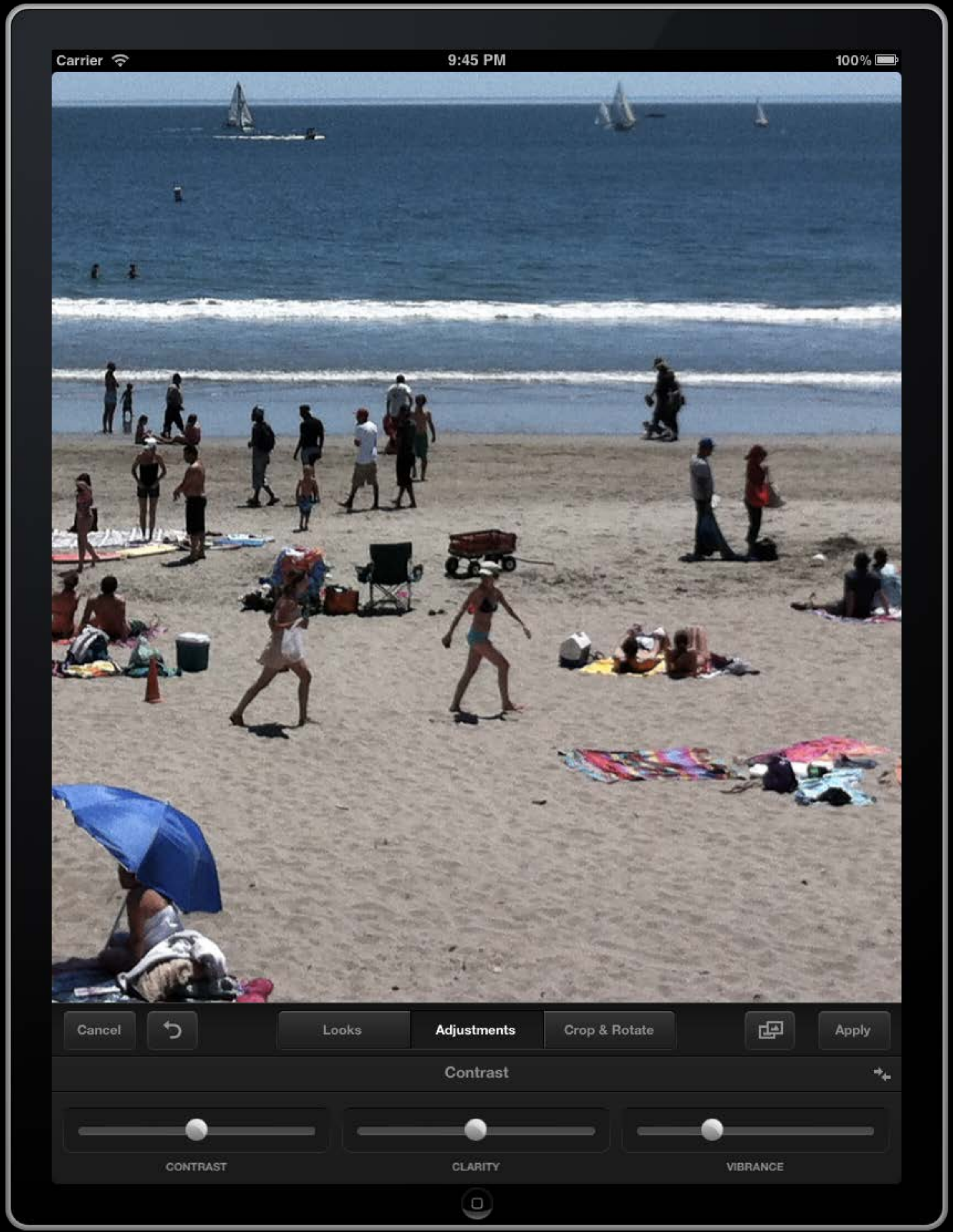
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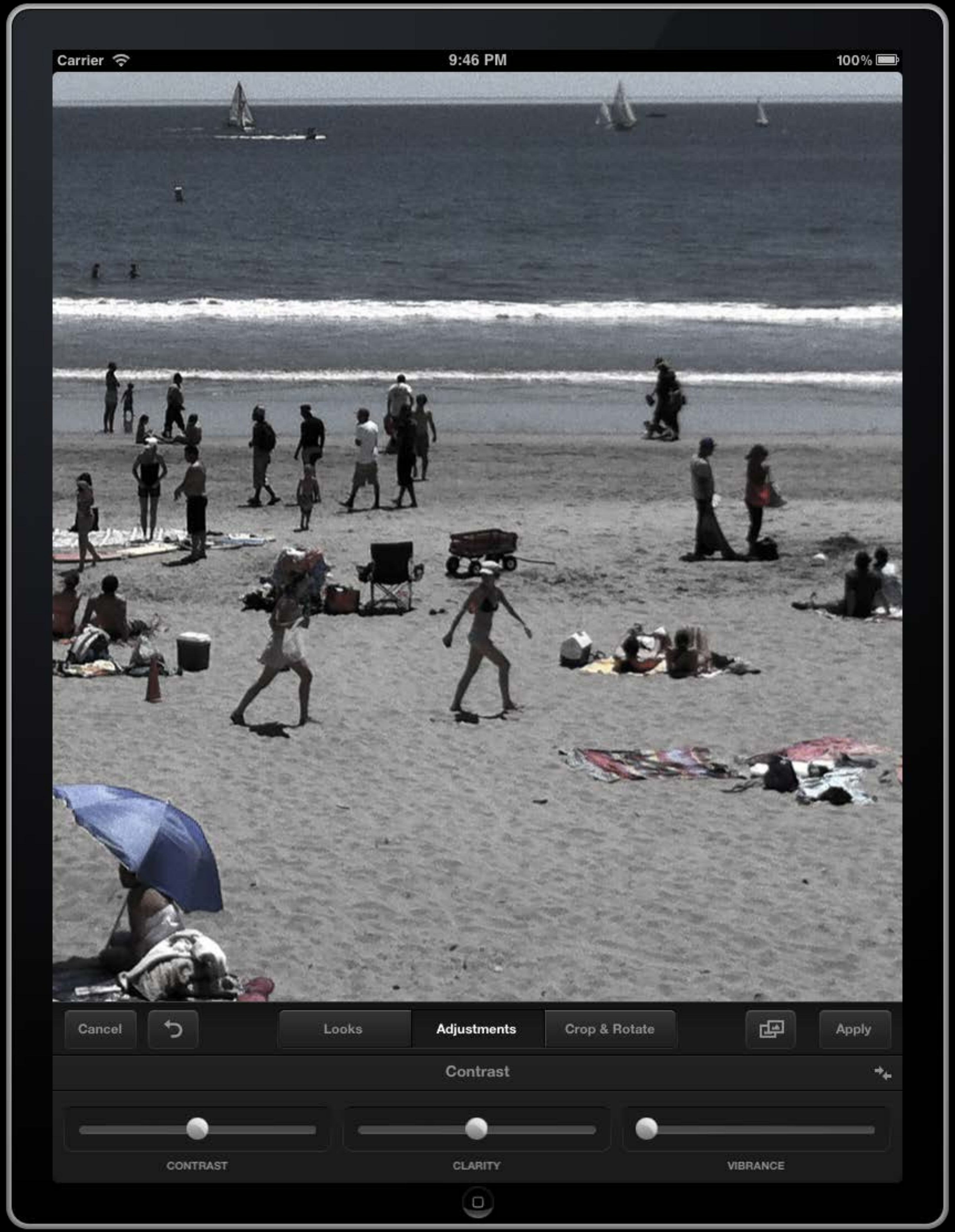
CONTRAST
CLARITY
VIBRANCE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Crop & Rotate
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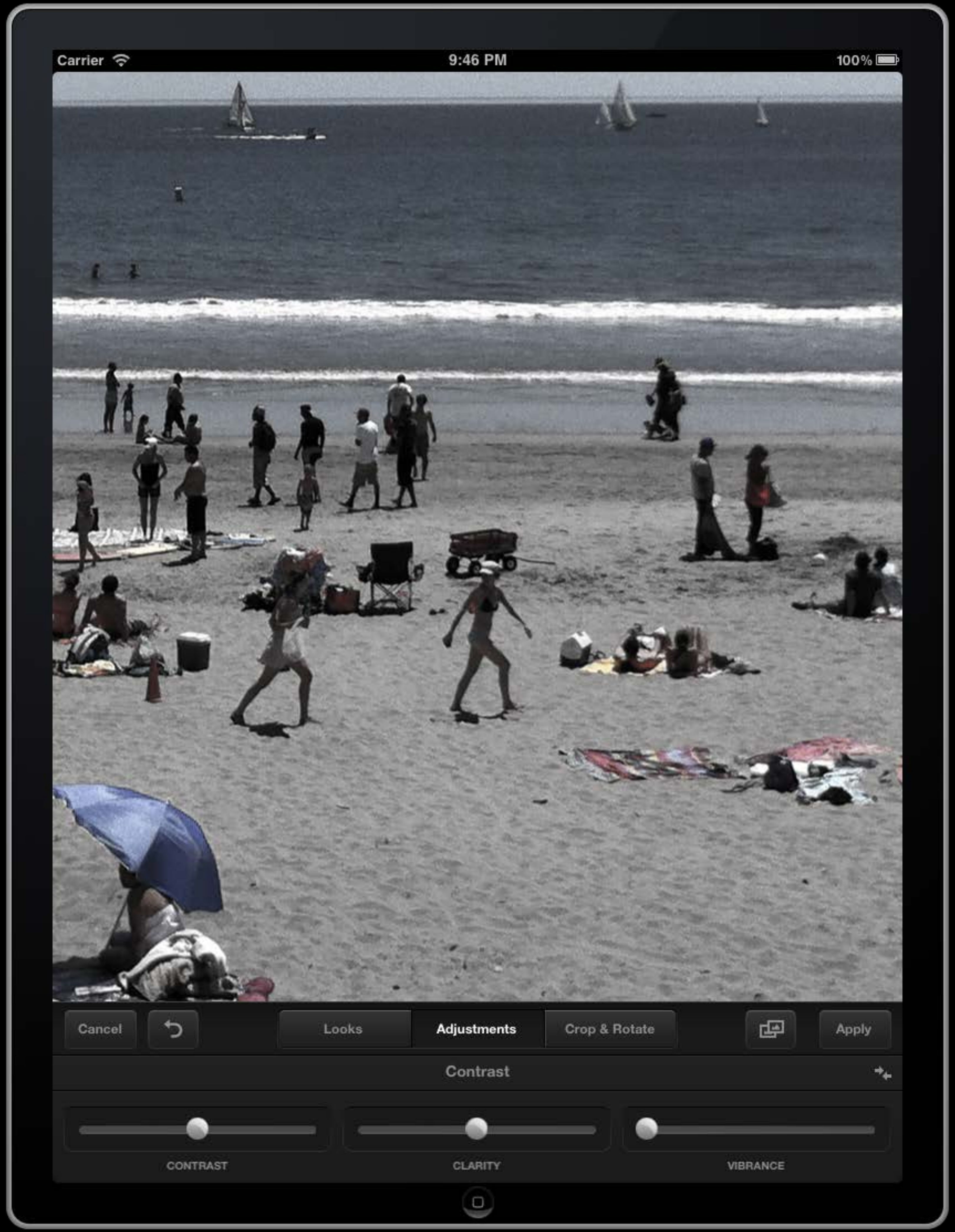
Contrast
CONTRAST
CLARITY
VIBRANCE

Adobe



Carrier
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CLARITY
VIBRANCE


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Crop & Rotate
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Photoshop on the iPad

Adobe

Photoshop on the iPad

- Goal is to bring *real* photoshop to new devices and new customers
- Fast, fluid, and fully compatible with the desktop product

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- **photoshop**is**hiring**.com

Adobe