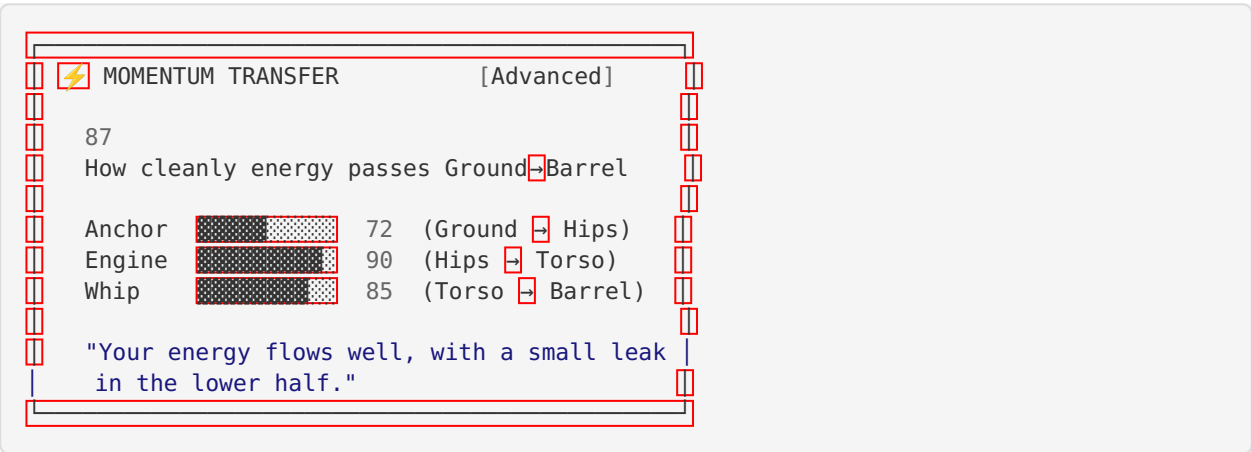# Momentum Transfer Card — UI Specification

Version: 1.0

Last Updated: November 26, 2024

Overview

The **Momentum Transfer Card** is the primary visual component for displaying swing analysis results in the BARRELS app. It shows the Momentum Transfer Score (the master metric) along with Anchor/Engine/Whip sub-scores and AI-generated coaching feedback.

1. Visual Layout

The card appears at the **TOP** of every swing report, above detailed metrics and drill recommendations.

```
┌─────────────────────────────────────────┐
│  ⚡ MOMENTUM TRANSFER         [Advanced]  │
│                                           │
│  87                                       │
│  How cleanly energy passes Ground→Barrel  │
│                                           │
│  Anchor  ███████░░  72  (Ground → Hips)   │
│  Engine  █████████  90  (Hips → Torso)    │
│  Whip    ████████░  85  (Torso → Barrel)  │
│                                           │
│  "Your energy flows well, with a small leak |
| in the lower half."                        │
└─────────────────────────────────────────┘
```

2. Component Props (TypeScript)

```typescript
import type { MomentumTransferAnalysis } from '@/lib/scoring/analysis-output-types';

interface MomentumTransferCardProps {
  analysis: MomentumTransferAnalysis;   // Full JSON structure
  showCoaching?: boolean;               // Show AI-generated coaching text
  showTimingDetails?: boolean;          // Show expandable timing section
}
```

Full Data Structure:

```typescript
interface MomentumTransferAnalysis {
  videoId: string;
  athlete: {
    name: string;
    level: 'MLB' | 'College' | 'HS' | 'Youth';
    age: number;
    bats: 'R' | 'L' | 'S';
    throws: 'R' | 'L' | 'S';
  };
  scores: {
    momentumTransfer: {
      score: number;                // 0-100
      goatyBand: number;            // -3 to +3
      goatyLabel: string;           // "Elite", "Advanced", etc.
      confidence: number;           // 0.0-1.0
    };
    anchor: {
      score: number;                // 0-100
      label: string;                // "Ground → Hips"
      leakSeverity: 'none' | 'mild' | 'moderate' | 'severe';
    };
    engine: {
      score: number;
      label: string;                // "Hips → Torso"
      leakSeverity: 'none' | 'mild' | 'moderate' | 'severe';
    };
    whip: {
      score: number;
      label: string;                // "Torso → Barrel"
      leakSeverity: 'none' | 'mild' | 'moderate' | 'severe';
    };
  };
  timing: {
    abRatio: number;
    loadDurationMs: number;
    swingDurationMs: number;
    sequenceOrder: string[];
    segmentGapsMs: {
      pelvisToTorso: number;
      torsoToHands: number;
      handsToBat: number;
    };
  };
  flags: {
    mainLeak: 'anchor' | 'engine' | 'whip' | 'none';
    secondaryLeak: 'anchor' | 'engine' | 'whip' | null;
    sequenceBroken: boolean;
  };
  coachSummary: {
    overall: string;                // 1-2 sentences about MTS
    leak: string;                   // 1-2 sentences about leak location
    nextStep: string;               // 1 sentence with actionable focus
  };
}
```

3. UI Elements & Mapping

3.1 Header Section

UI Element	JSON Path	Example Value
Icon	Static	⚡ (Zap icon)
Title	Static	"MOMENTUM TRANSFER"
Badge	`scores.momentumTransfer.goatyLabel`	"Advanced"
Badge Color	Based on `scores.momentumTransfer.goatyBand`	Gold gradient

3.2 Main Score Display

UI Element	JSON Path	Example Value
Score Number	`scores.momentumTransfer.score`	87
Subtitle	Static	"How cleanly your swing passes energy Ground → Hips → Torso → Barrel"

3.3 Sub-Scores (Anchor/Engine/Whip)

UI Element	JSON Path	Example Value
Anchor Score	`scores.anchor.score`	72
Anchor Label	`scores.anchor.label`	"Ground → Hips"
Anchor Bar	Progress bar (0-100%)	72% filled
Anchor Leak	`scores.anchor.leakSeverity`	🔥 (1 flame)
Engine Score	`scores.engine.score`	90
Engine Label	`scores.engine.label`	"Hips → Torso"
Whip Score	`scores.whip.score`	85
Whip Label	`scores.whip.label`	"Torso → Barrel"

3.4 Leak Indicators

Use `leakSeverity` to show flame emojis:

- **none**: No indicator
- **mild**: 🔥 (1 flame, yellow)
- **moderate**: 🔥🔥 (2 flames, orange)
- **severe**: 🔥🔥🔥 (3 flames, red)

Highlight the **main leak** with a red border around the sub-score card.

3.5 Coaching Text

UI Element	JSON Path	Example Value
Overall	`coachSummary.overall`	"Your momentum transfer is 87, which is advanced…"
Leak	`coachSummary.leak`	"The lower body is late or unstable…"
Next Step	`coachSummary.nextStep`	"Next step: Learn to load into the ground…"

4. Color Rules (GOATY Bands)

Badge and accent colors based on `goatyBand` (-3 to +3):

Band	Label	Color	Tailwind Classes
+3	Elite	Green	`from-green-500 to-emerald-600`
+2	Advanced	Gold	`from-barrels-gold to-barrels-gold-light`
+1	Above Average	Blue	`from-blue-500 to-blue-600`
0	Average	Gray	`from-gray-400 to-gray-500`
-1	Below Average	Orange	`from-orange-500 to-orange-600`
-2, -3	Poor/Needs Work	Red	`from-red-500 to-red-600`

5. Usage Example

In a Video Analysis Page:

```
import { MomentumTransferCard } from '@/components/momentum-transfer-card';

export default async function VideoAnalysisPage({ params }: { params: { id: string } }
) {
  // Fetch analysis data from API
  const response = await fetch(`/api/videos/${params.id}/analysis-summary`);
  const analysis = await response.json();

  return (
    <div className="max-w-2xl mx-auto p-4">
      <MomentumTransferCard
        analysis={analysis}
        showCoaching={true}
        showTimingDetails={true}
      />

      {/* Other analysis components below... */}
    </div>
  );
}
```

6. API Integration

Endpoint: `GET /api/videos/[id]/analysis-summary`

Returns the full `MomentumTransferAnalysis` JSON structure.

Example Response:

```json
{
  "videoId": "mlb_ohtani_hr_01",
  "athlete": {
    "name": "Shohei Ohtani",
    "level": "MLB",
    "age": 30,
    "bats": "L",
    "throws": "R"
  },
  "scores": {
    "momentumTransfer": {
      "score": 94,
      "goatyBand": 3,
      "goatyLabel": "Elite",
      "confidence": 0.93
    },
    "anchor": {
      "score": 92,
      "label": "Ground → Hips",
      "leakSeverity": "none"
    },
    "engine": {
      "score": 96,
      "label": "Hips → Torso",
      "leakSeverity": "none"
    },
    "whip": {
      "score": 93,
      "label": "Torso → Barrel",
      "leakSeverity": "none"
    }
  },
  "timing": {
    "abRatio": 1.37,
    "loadDurationMs": 212,
    "swingDurationMs": 155,
    "sequenceOrder": ["pelvis", "torso", "hands", "bat"],
    "segmentGapsMs": {
      "pelvisToTorso": 38,
      "torsoToHands": 43,
      "handsToBat": 26
    }
  },
  "flags": {
    "mainLeak": "none",
    "secondaryLeak": null,
    "sequenceBroken": false
  },
  "coachSummary": {
    "overall": "Your momentum transfer is 94, which is elite. The energy flows from the ground, through your body, into the barrel with almost no leaks.",
    "leak": "There's no major leak here — the lower body, core, and barrel are all playing in the right order.",
    "nextStep": "The focus at this level is tiny refinements and repeating this pattern under different speeds and pitch types."
  }
}
```

7. Coach Rick AI Integration

The `coachSummary` field is generated by Coach Rick AI using the `/api/coach-rick` endpoint.

How It Works:

1. Scoring engine produces raw scores (Momentum Transfer, Anchor, Engine, Whip)
2. `formatAnalysisOutput()` in `lib/scoring/analysis-output.ts` calls `generateMomentumCoaching()`
3. Coaching logic identifies the main leak and generates 3-part explanation
4. Result is stored in `coachSummary` field
5. UI displays the coaching text directly

3-Part Structure:

1. **Overall**: Explain the Momentum Transfer score in 1-2 sentences
2. **Leak**: Identify where energy is lost (Anchor/Engine/Whip)
3. **Next Step**: One simple focus for the next rep (no drill names)

8. Responsive Design

- **Mobile (< 640px)**: Single column, full-width bars
- **Tablet (640-1024px)**: Slightly larger text, more spacing
- **Desktop (> 1024px)**: Max width 700px, centered

9. Animations

- **Card entry**: Fade in + slide up (0.5s duration)
- **Score counter**: Count up animation (0.8s duration)
- **Progress bars**: Fill from left to right with stagger (0.8s total)
- **Coaching text**: Fade in after bars complete (0.8s delay)

10. Accessibility

- All colors meet WCAG AA contrast standards (4.5:1 minimum)
- Progress bars include `aria-valuenow`, `aria-valuemin`, `aria-valuemax`
- Coaching text is semantic HTML (`<p>` tags)
- Keyboard navigation supported (expandable timing section)

11. Testing Checklist

Visual Tests:

- [ ] Card displays correctly on mobile (< 640px)
- [ ] Card displays correctly on desktop (> 1024px)

- [ ] All GOATY band colors render correctly (Elite, Advanced, Average, etc.)
- [ ] Leak indicators show correct number of flames
- [ ] Main leak has red border highlight
- [ ] Progress bars fill to correct percentages
- [ ] Coaching text is readable and wraps properly

Functional Tests:

- [ ] Timing details expand/collapse on button click
- [ ] All scores display correct values from API
- [ ] Coach summary text matches mock data
- [ ] No console errors or warnings
- [ ] TypeScript compiles without errors

Edge Cases:

- [ ] Score = 0 (should show empty bar)
- [ ] Score = 100 (should show full bar)
- [ ] All leakSeverity = "none" (no flame icons)
- [ ] All leakSeverity = "severe" (3 flames each)
- [ ] sequenceBroken = true (should show warning)
- [ ] Missing athlete data (graceful degradation)

---

12. File References

File	Purpose
`/components/momentum-transfer-card.tsx`	Main UI component
`/lib/scoring/analysis-output-types.ts`	TypeScript interfaces
`/lib/scoring/analysis-output.ts`	Output formatting logic
`/lib/momentum-coaching.ts`	Coaching text generation
`/app/api/videos/[id]/analysis-summary/route.ts`	API endpoint
`/app/api/coach-rick/route.ts`	Coach Rick AI endpoint

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13. Future Enhancements

- [ ] Add "Compare to Previous" button
- [ ] Show historical trend (Momentum Transfer over time)
- [ ] Add "Ask Coach Rick" inline chat button
- [ ] Show drill recommendations based on main leak

- [ ] Add video overlay showing leak location on skeleton
- [ ] Export report as PDF

Summary

The Momentum Transfer Card is a production-ready component that displays swing analysis results in a clear, mobile-friendly format. It integrates seamlessly with the scoring engine, Coach Rick AI, and the BARRELS design system.

Key Features:
- ✅ Standardized JSON structure
- ✅ GOATY band color coding
- ✅ Leak severity indicators
- ✅ AI-generated coaching feedback
- ✅ Expandable timing details
- ✅ Responsive design
- ✅ WCAG AA accessible
- ✅ TypeScript type-safe

Questions? Contact the development team or refer to the implementation files listed above.