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REMOTE AIR BAG REPORT

CASE NUMBER - IN99-079
LOCATION - LOUISIANA
VEHICLE - 1995 TOYOTA COROLLA DX
CRASH DATE - October, 1996

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

Technical Report Documentation Page

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16. <i>Abstract</i> This report covers a remote investigation of an air bag deployment crash that involved a 1995 Toyota Corolla DX (case vehicle), and a concrete curb, a shrub, and a brick wall. This crash is of special interest because the case vehicle's restrained driver (85-year-old female) sustained a serious thoracic injury from the steering wheel assembly, during a relatively low speed crash, and died 159 days post-crash from medical complications. It should be noted that our sponsor (NHTSA) had multiple independent medical reviews performed on this case and no direct link can be established between the driver's air bag-related injuries and the subsequent death of the driver. The case vehicle had originally been traveling south in an unknown southbound lane of a one-way, undivided, city street. The case vehicle's driver made a left-hand (eastward) turn into a bank parking lot and traveled eastward for a short distance prior to making a right-hand (southeastward) turn into an angled parking slot. At some point during the turning process into the parking slot, the case vehicle's driver reportedly experienced a syncopic episode. The crash occurred at the end of the parking slot. The case vehicle's front left bumper impacted a shrub and, almost simultaneously, the front right corner impacted a brick wall. The case vehicle's impact with the brick wall caused the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle rotated slightly clockwise an unknown number of degrees and rebounded back into the parking lot approximately 0.9 meters (three feet). The case vehicle's driver was seated with her seat track located in its forward-most position, and her tilt steering wheel was located in an unknown position. She was restrained by her available, active, three-point, lap-and-shoulder, safety belt system and sustained, according to some of her medical records and the medical information provided by her attorney, serious injuries which included: contusions to her right lung and right brachial plexus. In addition, she sustained a heart contusion; fractures to her left nasal bone, bilateral anterior maxillary sinus walls, and right 1 st and 2 nd ribs; a cervical strain; and lacerations to her scalp, lip, mouth, neck, chest, and right thumb. In addition, she sustained multiple abrasions and contusions as well as bilateral knee sprains.					
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This remote report was brought to NHTSA's attention on July 31, 1999, by an attorney representing the family of the deceased driver. This crash involved a 1995 Toyota Corolla DX (case vehicle), and a concrete curb, a shrub, and a brick wall. The crash occurred in October, 1996, at 1:19 p.m., in Louisiana, and was investigated by the applicable municipal police department. This crash is of special interest because the case vehicle's restrained driver [85-year-old, White (unknown if Hispanic) female] sustained a serious thoracic injury from the steering wheel assembly, during a relatively low speed crash, and died 159 days post-crash from medical complications. Because her time of death exceeds 30 days post-crash, this crash does not qualify for inclusion within the Fatality Analysis Reporting System (FARS). It should be noted that our sponsor (NHTSA) had multiple independent medical reviews performed on this case and no direct link can be established between the driver's air bag-related injuries and the subsequent death of the driver. This contractor contacted the attorney on August 11, 1999. On August 16th, a packet from the attorney was received that included a summary of the deceased driver's medical information; reports by the attorney's experts; witness depositions; and photographs of the crash scene, the repaired case vehicle, and removed case vehicle's damaged components. A copy of the Pre-Trial Order was received on August 23, 1999. A telephone conversation with the attorney was held on August 25th. An e-mail from the attorney containing the depositions of three experts was received on September 3, 1999. Four insurance photographs were obtained on November 15, 1999. This contractor did not inspect the scene or the case vehicle. This report is based on the Police Crash Report, telephone conversations with the attorney, contents of several depositions, the deposition of the investigating police officer, attorney-provided scene and vehicle photographs, insurance company-provided photographs, occupant kinematic principles, attorney-provided medical information, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle had originally been traveling south in an unknown southbound lane of a one-way, undivided, city street. The case vehicle's driver made a left-hand (eastward) turn into a bank parking lot and traveled eastward for a short distance (**Figure 1**) prior to making a right-hand (southeastward) turn into an angled parking slot. The parking lot driveway was straight and level at the area of impact. The pavement was bituminous. Pavement markings consisted of a diagonal, single, solid yellow, parking slot line on the left side of the parking slot entered by the case vehicle and a diagonal, single, solid blue parking slot line on the right side. Yellow lines indicated regular parking slots and blue lines identified slots for the handicapped. The handicapped parking slots were also identified by signage, and there were no visible traffic



Figure 1: Case vehicle's approach path of travel in bank parking lot; Note: location (arrow) of impact is highlighted (case photo #01)

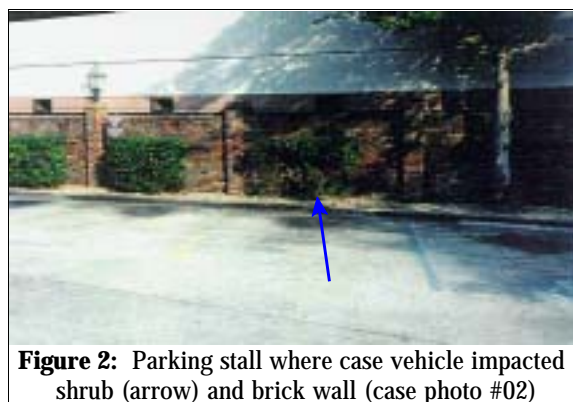


Figure 2: Parking stall where case vehicle impacted shrub (arrow) and brick wall (case photo #02)

controls. At the time of the crash, the light conditions were daylight, the atmospheric conditions were clear, and the road pavement was dry. Traffic density is unknown, and the site of the crash was a combination of urban residential and commercial.

At some point during the turning process into the parking slot, the case vehicle's driver reportedly experienced a syncopic episode which resulted in the case vehicle's driver not making any avoidance maneuvers prior to the crash. The crash occurred at the end of the third diagonal parking slot (i.e., east of the two handicapped slots) on the west end of the bank parking lot's south side (**Figure 2** above).



Figure 3: Close-up of case vehicle's impact area with shrub and brick wall (case photo #03)



Figure 4: Distance between parking lot's curb and brick wall which enabled case vehicle's front to impact wall at approximately same time as right front tire struck curb (case photo #06)

The exact order of the impact sequence is unknown, but the most likely scenario is that the case vehicle's right front tire contacted and overrode (i.e., without any evidence of wheel damage) a concrete curb, followed by the front left bumper impacting a shrub, and finally, the front right corner impacting the brick wall (**Figures 3, 4, and 5, and Figure 6** below) at the end of the parking slot. The case vehicle's impact with the brick wall caused the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle rotated slightly clockwise an unknown number of degrees and rebounded back into the parking lot approximately 0.9 meters (three feet).



Figure 5: Case vehicle's damaged front showing damage to right hood, headlight assembly, and fender; Note: damage extends across entire front bumper (case photo #07)

CASE VEHICLE

The 1995 Toyota Corolla DX was a front wheel drive, five-passenger, four-door sedan (VIN: 1NXAE09B8SZ-----) equipped with a 1.8 liter, DOHC-EFI, I-4 gasoline engine and either a five-speed manual (standard) or a four-speed automatic (optional) transmission. Four-wheel anti-lock brakes were an option for this vehicle, but it is not known if the case vehicle was so

equipped. The case vehicle's wheelbase was 246 centimeters (97.0 inches), and an odometer reading of 4,635 kilometers (2,880 miles) was reported.



Figure 6: Induced damage to case vehicle's left fender; Note: there was direct damage to the front left bumper (case photo #08)



Figure 7: Overhead view of direct damage to front right area of case vehicle's hood; Note: hood has been removed from vehicle (case photo #13)



Figure 8: Case vehicle's damaged front bumper showing direct contact laterally across bumper and vertically at front left corner (case photo #20)



Figure 9: Close-up of vertically oriented direct damage at case vehicle's front left bumper; Note: contact came from shrub (case photo #21)

The case vehicle was assessed as disabled by the investigating officer, but the Police Crash Report indicated that it was left at the scene. The actual disposition of the case vehicle is not known, but it was repaired by the family. Based on the available photographs, the case vehicle sustained damage from its impact with the brick wall, across approximately two-thirds of the front bumper and to the right headlight assembly, fender, and hood (**Figure 5** above and **Figure 7**). The impact with the shrub caused overlapping damage across the front bumper, but also produced a distinct vertical damage mark on the left bumper (**Figures 8** and **9**).

Based on available photographs, CDCs were estimated as: **12-FZEW-1 (10)** for the impact with the brick wall [maximum crush was 13.2 centimeters (5.2 inches)] and **12-FLEN-1 (10)** for the shrub impact. The WinSMASH reconstruction program, barrier algorithm, was used on the case vehicle's highest severity impact with the brick wall and provided a borderline reconstruction, but the results appear reasonable. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 24.9 km.p.h. (15.5 m.p.h.), -24.5 km.p.h. (-15.2 m.p.h.), and -4.3 km.p.h. (-2.7 m.p.h.).

The case vehicle's driver air bag was located in the steering wheel hub (**Figure 10**). Attorney-provided photographs show the driver air bag module's cover flaps and air bag and revealed that the cover flaps opened at the designated tear points and were in a symmetrical "H" configuration. There is inconclusive evidence regarding the possibility of driver contact to the air bag module's cover flaps. On the top cover flap, at the bottom of the manufacturer's logo and just left of center on the horizontal seam, there is possible contact evidence (**Figure 11**). The bottom cover flap also reveals some inconclusive evidence regarding driver contact. Three longitudinal discoloration marks appear to be present in the top left of the flap, with one mark starting near the center of the horizontal seam and the other two located to the left of the first. Another discoloration area is located at the bottom cover flap's lower right corner (**Figure 12**). A combination of available photographs and the depositions provided the following air bag information. The driver's air bag was designed without any tethers. The driver's air bag had two vent ports, approximately 3 centimeters (1.2 inches) in diameter, located at the 11:30 and 12:30 o'clock positions on the back side of the air bag. The deployed driver's air bag was round with a diameter of 67 centimeters (26.4 inches). There was a large bloodstain to the driver air bag's fabric, immediately upward from and to the right of center (**Figures 13 and 14** below).



Figure 10: Case vehicle's front seating area, post repair, showing driver's steering wheel-mounted air bag module and mid instrument panel-mounted (arrow) front right air bag module (case photo #22)



Figure 11: Case vehicle driver air bag module's top cover flap showing two (arrows) areas of possible skin transfer evidence (case photo #27)

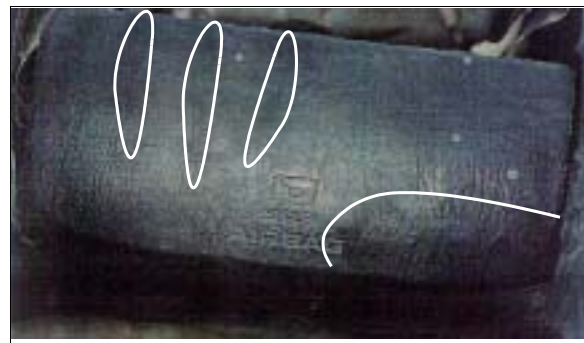


Figure 12: Case vehicle driver air bag module's bottom cover flap showing areas of possible occupant contact (case photo #28)

A photograph of the repaired case vehicle (**Figure 10**) shows the replaced front right passenger air bag module to be located in the middle of the instrument panel. The available

photographs of the front right air bag module's cover flap reveal that the cover flap opened at the designated tear points, and there is no conclusive evidence that the cover flap was damaged during the deployment; although, there is probable damage across the bottom surface, contiguous to the seam, from an unknown source. However, there is no indication of damage to the right side of the case vehicle's windshield (**Figure 5** above). Because there are no photographs of the front right air bag's fabric, it is not known if: (1) the air bag's fabric was damaged during the deployment; (2) the air bag was designed with any tethers; (3) the air bag had any vent ports (and if they existed, the number, size, and location); and (4) the air bag's fabric had any possible evidence of driver contact. In addition, the front right air bag's shape and dimensions are not known. Finally, no photographs are available of the case vehicle's post-crash interior prior to repair; therefore, there is no evidence of occupant contact on any of the interior surfaces of the case vehicle.

CASE VEHICLE DRIVER

The attorney-provided depositions indicated that the case vehicle's driver [85-year-old, White (unknown if Hispanic) female; 155 centimeters and 61 kilograms (61 inches, 135 pounds)] was seated in an upright posture, as she passed by a witness, with her back against the seat back; however, the exact location of her feet and hands are unknown. The depositions indicated that the driver usually drove with her hands at the 10 and 2 clock positions with her seat located in its forward-most position. Her seat back position (upright versus reclined) is not known. A tilt steering wheel was standard equipment on the case vehicle, but the exact position of her tilt steering wheel prior to the crash is not known.

Based on witness testimony, the case vehicle's driver was restrained by her available, active, three-point, lap-and-shoulder, safety belt system. There was evidence of possible belt pattern bruising and/or abrasions to the driver's left shoulder, left chest, and left breast. However, air bag-related abrasions and contusions were present in the same bodily regions. The exact source of these lesions could not be separated and preference in out injury coding was given to the air bag. Furthermore, there was no mention in the depositions of the driver depositing evidence of loading on her seat belt webbing, "D"-ring, or latch plate, and there were no attorney-provided photographs that would have enabled this contractor to evaluate the case vehicle's driver safety belt for evidence of loading.



Figure 13: Case vehicle's removed (i.e., cut out) driver air bag showing evidence (i.e., bloodstain) of occupant contact (case photo #23)



Figure 14: Close-up of occupant contact evidence (i.e., bloodstain) in center of case vehicle's driver air bag (case photo #24)

The case vehicle's driver made no known pre-crash avoidance maneuvers because of her reported syncopic episode. Witness depositions indicated that the case vehicle's driver was noticed sitting in an upright position as she passed by en route to a parking slot. The alleged syncopic episode most likely occurred immediately after she made her right-hand turn into the parking slot, given the short distance between the parking lot's driveway and the brick wall at the end of the parking slots (**Figures 1 and 2** above). The posture of the case vehicle's driver at the instant of impact is not known. She may have been sitting upright, slumped forward, or leaning to one side or the other. In the absence of any avoidance maneuver, the driver's pre-impact body position likely remained unchanged immediately prior to impact. The impact of the case vehicle's right front tire and wheel with the 15.2 centimeter (6 inch) concrete curb, the front left bumper with the shrub, and the front right bumper corner with the brick wall were virtually simultaneous. These impacts enabled the driver to continue forward and move slightly upward as the case vehicle decelerated. Because of her close proximity to the steering wheel, the case vehicle's driver most likely began to load her safety belts about the same time as she began to contact her deploying air bag. Based on the photographs provided by the attorney's consultant, the case vehicle's steering wheel was deformed (in some unknown manner) from her loading. When the case vehicle rotated slightly clockwise, further into the shrub, the driver's posture was altered, and she slid a little to her left. As the case vehicle was rotating clockwise, additional portions of the case vehicle's front bumper (i.e., up to and including the approximate right two-thirds) came into contact with the brick wall. The case vehicle rebounded from contact with the brick wall backwards into the parking slots. As a result, the driver rebounded backwards toward the left side of her seat. During her rearward movement, her head most likely struck the left "B"-pillar, window frame, and/or sill.

DRIVER INJURIES

The driver was transported from the scene by ambulance to a medical facility where she was hospitalized overnight before being transferred to another medical facility. She sustained serious injuries from the crash and was hospitalized for 51 days post-crash before being transferred to a long term care facility. During the approximate five month period post-crash she was transferred to several long term care facilities and occasionally back to a hospital for treatment. She died 159 days post-crash. The injuries sustained by the case vehicle's driver during the crash included: contusions to her heart, right lung, and right brachial plexus—including complete paralysis of her right upper extremity; fractures to her left nasal bone, bilateral anterior maxillary sinus walls, and right 1st and 2nd ribs; a cervical strain; and lacerations to the top, left, and back of her scalp, as well as lacerations to her lip, mouth, neck, chest, and right thumb. In addition, she sustained multiple abrasions to her face, anterior neck, and chest, as well as multiple contusions to her head, face, right eye, mouth and tongue, anterior neck, chest, bilateral shoulders, upper right arm, right hand, and bilateral knees and lower legs. She also sprained her right and left knees. According to her medical records, the abrasions and contusions to her lower face and anterior neck resulted in swelling to such an extent that she was described as "unrecognizable". According to the Diagnoses on this patient's death summary, she died of anemia, chronic renal failure, respiratory failure, and possibly aspiration. Her reviewed medical records indicated that she was diagnosed (approximately 72 days post-crash) with end stage renal disease, meaning that her kidneys were never going to be able to function on their own again. As a result she was on scheduled dialysis

her remaining time. The cause of her end stage renal disease was reported as probably aggravated from the medicines she needed in order to fight off the infections (i.e., septicemia¹) that occurred as a complication of her crash. In summary, based on the medical information available, the injuries this patient sustained during her crash started her health on a downward decline from which she never recovered. However, because of her age (85) and pre-existing chronic medical conditions (including cardiomyopathy-like syndrome, hypertension, renal failure, and chronic obstructive pulmonary disease–bronchitic in type), the medical information never established a causative link between the injuries she sustained in the crash and ultimately her death. It should be noted that our sponsor (NHTSA) had multiple independent medical reviews performed on this case and no direct link can be established between the driver’s air bag-related injuries and the subsequent death of the driver.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion heart, location not specified	441002.1 minor	Steering wheel hub and spokes	Probable	Hospitalization records
2	Contusion(s) right lung with bilateral pleural effusions requiring, initially, mechanical ventilation ²	441406.3 serious	Steering wheel hub, spokes, and rim	Probable	Hospitalization records
3	Contusion {stretching injury} right brachial plexus with permanent paralysis of right upper extremity	630222.3 serious	Unknown contact mechanism	Unknown	Hospitalization records
4	Contusion back of head {occiput}	190402.1 minor	Left “B”-pillar	Possible	Other: attorney provided ³
5	Laceration, 2.5 cm (1 in) back of head {occiput}	190602.1 minor	Left “B”-pillar	Possible	Other: attorney provided
6	Laceration mid to left vertex of scalp {parietal area}	190602.1 minor	Left “B”-pillar	Possible	Other: attorney provided
7	Laceration behind left ear {temporal area} with arterial, brisk bleeding	190602.1 minor	Left “B”-pillar	Possible	Other: attorney provided
8	Contusions, multiple, head, not further specified	190402.1 minor	Seat back support	Probable	Other: attorney provided

¹ The following term is defined in DORLAND’S ILLUSTRATED MEDICAL DICTIONARY as follows:
Septicemia (sep"ti-se'me-a): systemic disease associated with the presence and persistence of pathogenic microorganisms or their toxins in the blood. Called also *blood poisoning*.

² This patient required mechanical ventilation on and off throughout her extended medical treatments and at the time of her death.

³ The attorney representing the family of the case vehicle’s driver provided her medical information to this contractor. From our review of the information, the vast majority of the injury descriptions were based on hospitalization records while only table rows 4 and 16 were based on emergency room-related medical records.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
9	Fracture left nasal bone with slight displacement ⁴	251004.2 moderate	Air bag, driver's	Probable	Hospitalization records
10	Fractures, bilateral anterior maxillary sinus walls ³	250800.2 moderate	Air bag, driver's	Probable	Hospitalization records
11 12 13	Abrasions ⁵ , multiple, facial, including left forehead, bilateral cheeks, lips and right chin (mandible) area with excoriation ⁶ to cheeks and lips	290202.1 290202.1 290202.1 minor	Air bag, driver's	Probable	Other: attorney provided
14	Contusions ⁴ , multiple with edema and swelling ⁷ to face including left forehead {hematoma}, underneath right eye ⁸ {bruising}, nasal area {ecchymosis}, and chin {ecchymosis} [Aspect = Whole]	290402.1 minor	Air bag, driver's	Probable	Other: attorney provided
15	Contusion {ecchymosis} right periorbital area	297402.1 minor	Air bag, driver's	Probable	Other: attorney provided
16	Lacerations, small, 2 mm (0.08 in) above upper lip	290602.1 minor	Air bag, driver's	Probable	Other: attorney provided
17	Contusion {bruise}, 2 mm (0.08 in) left tongue	243099.1 minor	Air bag, driver's	Probable	Other: attorney provided
18	Contusion {ecchymosis} mucosa of mouth	243202.1 minor	Air bag, driver's	Probable	Other: attorney provided
19	Lacerations, small, mouth (mucosa)	243204.1 minor	Air bag, driver's	Probable	Other: attorney provided
20	Strain {sprain}, severe, cervical spine	640278.1 minor	Air bag, driver's	Probable	Hospitalization records
21	Abrasions {friction burns}, multiple, anterior neck ³	390202.1 minor	Air bag, driver's	Probable	Hospitalization records

⁴ This lesion was noted in the medical records reviewed by this contractor; however, greater detail was provided by the attorney.

⁵ The medical records reviewed by this contractor indicated only that there were abrasions and contusions to the lower face and anterior neck.

⁶ The following term is defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:
excoriations (eks-kor"e-a'shen): a scratch or abrasion of the skin.

⁷ According to the medical records reviewed by this contractor, the patient was initially unrecognizable because of the severe/tremendous swelling of her lower face and neck.

⁸ This lesion could be the same as the periorbital ecchymosis cited below.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
22 23	Contusions {ecchymosis, hematoma} with edema ⁶ anterior neck including a huge hematoma right mid to lower right neck ³	390402.1 390402.1 minor	Air bag, driver's	Probable	Hospitalization records
24	Lacerations ⁹ {scratches} to neck, not further specified	390600.1 minor	Air bag, driver's	Possible	Other: attorney provided
25	Fracture right 1 st and 2 nd ribs, not further specified	450220.2 moderate	Steering wheel rim	Probable	Other: attorney provided
26	Abrasions {friction burns}, multiple to chest, locations not further specified	490202.1 minor	Air bag, driver's	Probable	Other: attorney provided
27	Contusions {bruising, ecchymosis, hematoma} whole chest including breasts bilaterally	490402.1 minor	Air bag, driver's	Probable	Other: attorney provided
28	Lacerations ¹⁰ , multiple, chest, locations not further specified	490600.1 minor	Air bag, driver's	Possible	Other: attorney provided
29	Contusions {ecchymoses} to right and left shoulders and right upper arm, including axilla	790402.1 minor	Air bag, driver's	Probable	Other: attorney provided
30	Contusion {bruises, ecchymosis} with edema to dorsum right hand	790402.1 minor	Air bag, driver's	Possible	Other: attorney provided
31	Laceration right thumb, not further specified	790600.1 minor	Air bag, driver's	Possible	Other: attorney provided
32 33	Sprain right and left knees, right worse than left ³	850826.2 850826.2 moderate	Knee bolster, driver's	Probable	Hospitalization records
34	Contusions {bruises, ecchymoses, hematomas} with swelling right and left knees ³	890402.1 minor	Knee bolster, driver's	Probable	Hospitalization records
35	Contusions {bruising} bilateral lower legs, not further specified	890402.1 minor	Left instrument panel and below	Probable	Other: attorney provided

⁹ These lesions could be the same as the abrasions cited to the neck above (i.e., different observer, different interpretation).

¹⁰ These lesions could be the same as the abrasions cited to the chest above (i.e., different observer, different interpretation).