

195 Clepington Road,
Dundee,
Scotland.
23rd February 1970

Dear Harold,

I enclose a copy of "Analysis of Zapruder frames 222 to 244" which I have just completed. I also enclose a copy of letter which I sent to "Life" accompanying the analysis. I have sent copies to Gary Schoener and Richard Sprague. I would hope that "Life" might publish the work but doubt this in view of its length.

I read in Sylvia Meagher's "Accessories", on p.23-24 of a film taken by Ralph Simpson - do you know anything about this film?

I hope you got the PARIS MATCH issues alright. In your letter of August 14 you said "Lady Jean Campbell (Lond. Eve. Standard) travelled with US Paris-Match photog. time ass. They may have his pix. . . ." - is the man's name correct?

I still do not have an index to 26 vols. Do you know if it has been reprinted.

I hope my analysis does not take up too much of your time - it is best to read it with a copy of "Life" Nov. 28 1966 and a magnifying glass. I believe if you view Zap. film in Archives at normal and slowed speeds you will see the movements I note in the analysis.

I look forward to hearing from you in the future.

Yours faithfully,

Chris Longbottom

(CHRIS LONGBOTTOM)

195 Clepington Road,

DUNDEE,

Angus,

Scotland.

13th February, 1970.

Dear Sir,

I am a 22 year old student at Dundee University and I am extremely interested in the subject of the Assassination of President Kennedy. I enclose a copy of "Analysis of Zapruder frames 222 to 244", which I have recently completed, and I would be pleased if you would let me know your opinion of it.

I am not a photographic expert but I believe I may have discovered something of importance through photo-analysis of the Zapruder frames 222 to 244 which appeared in the November 28, 1966 edition of "LIFE INTERNATIONAL". I am sending you a copy of the work and hoping that it might be possible for you to reconsider your position with regard to films and photos, taken at the time of the assassination, that you possess (Zapruder film, Hughes film, Bell film, Betzner photo, Rickerby photo, Dorman photo, T. Towner film, J. Towner photo, Paschall film and any others you own) and make them, or best copies and prints of them, available to researchers. I feel that if I, being far from expert, can discover something as basic and important as the exact frame at which Governor Connally was shot, then photographic experts and other researchers would almost certainly be able to discover yet further intelligence contained in the films and photos. I look forward to hearing from you in the near future.

Yours faithfully,

C. LONGBOTTOM.

ANALYSIS OF ZAPRUDER FRAMES 222 TO 244

The problem of photo-analysis is that photographs portray in two dimensions that which occurred in three dimensions. In the case of successive movie frames it is possible to introduce some degree of measure of the third dimension, depth, by relating the movements between the various images relative to each other and the movements of the images themselves. By comparing the relationships of the images frame by frame, and relating this to the overall sequence it is possible to judge the movements in three dimensions throughout the sequence.

In the case of the Zapruder film sequence frames 222 to 244 published in November 28, 1966 edition of "Life International" it is possible to use the various shadows cast, as well as the obvious angles, distances, and relative movements (due to movement of car and occupants - taking parallax into account) in a determination of what movements, in three dimensions, each occupant made. This analysis is mainly concerned with the movements of Governor John B. Connally throughout the sequence.

The fact that Connally's coat was black is an added problem in relating his movements to three dimensions since the black cloth does not show up folds very well and tends to present a flat image (both President Kennedy and Mrs. Kennedy were wearing coats which showed up the shadows of the folds of the cloth and thus aid in 3-d reading of the frames with respect to their movements).

The car was travelling from left to right of Zapruder at a speed of just over 11m.p.h., with Zapruder's film running at 18.3 frames per second. The car thus moved forwards almost a foot between frames of the film. At frame 222 the car was about 95 feet from Zapruder with Zapruder filming at an angle of about 43° to President Kennedy in the direction of movement of the car.

The road was not simply running left to right, the direction of/

of movement of the car was angled to Zapruder, so that at frame 244 the car was about 80 feet from Zapruder, who was now filming at an angle of 52° to the President in the direction of movement of the car. Thus there was an alteration in angulation of camera to car of approximately 9° . This small angulation alteration, the relatively large distance involved, plus the original angulation involved indicate that there would be only slight alterations in the relationships of the occupants of the car to one another, had they remained stationary, from beginning to end of sequence. This is borne out by noting the relative movement of fixed objects on the car between frames 222 and 244.

Zapruder's camera was directed at approximately 14° N of E at frame 222 and 5° N of E at frame 244; the time of the assassination was 12.30p.m., thus the sun was just W of S. Therefore, the camera was directed at almost 90° to the direction of the sunlight throughout this sequence of 23 frames. This is important in the reading of the shadows appearing in the frames.

The time from frame 222 to frame 244 is 1.27 seconds - this must be borne in mind in assessing the speed of movement of the occupants of the car, as must the fact that the time between consecutive frames is 0.055 seconds.

At frame 222 Governor Connally (hereafter referred to as JC) is between Zapruder and Mrs. Kennedy (hereafter referred to as JK), obscuring most of her from view; there is a little of JK's left arm visible beyond JC's left arm but the rest of her which is visible is above JC's head and shoulders. The relative movement between JC and JK, if both were stationary, through the sequence can be seen to be JC moving to the right (in the picture - hereafter shortened to i.p.; this is to distinguish right and left/

left (i.p.) from occupant's right and left) relative to JK. Thus, if both JC, who is almost square-on to the camera, and JK remained at their positions in f.222, one can see that in the succeeding frames several points of reference would move relative to each other:-

- (1) the amount of JK's left arm visible to right (i.p.) of JC's left arm would decrease.
- (2) the amount of JK's right arm, elbow, and roses at her right side, visible to left (i.p.) of JC's right shoulder (see later frames than f.222) would increase.
- (3) the line down the left side (i.p.) of JC's head would pass to the right (i.p.) relative to the line down the left side (i.p.) of JK's head (hair); and the amount of JK's left coat collar, coloured blue, visible to right (i.p.) of JC's head, would decrease.
- (4) JC's head would gradually decrease the amount and length of his left shoulder visible.
- (5) the length of both right and left shoulders of JC would decrease slightly (due simply to relative movement, disregarding the head).
- (6) the tip of JC's left (and right) shoulder(s) would move to left (i.p.) of the metal frame which is visible positioned between front seats and jump-seats in the car.
- (7) JC's hat (seen, in f.222, to the left of the metal strip at the front of the glass panel on the near side of the car, just above the edge of the car and below and slightly left (i.p.) of the tip of JC's left shoulder) would move to left (i.p.) of the metal strip, and a greater amount of it would become visible.

All of these movements and the distances moved would be relatively/

relatively small, as can be seen by observing the relative movement of the metal frame and JK (who remains in a fixed position through f.222 to f.232) - at f.222 the tip of JK's left shoulder is about halfway between the metal frame and the metal strip, at back and front, respectively, of the glass panel, being a little nearer to the frame than the strip. Through the succeeding frames the tip of JK's left shoulder moves left (i.p.), as one would expect, relative to the metal frame, till at f.231 it is obscured by the metal frame, and in f.232 it is just to left (i.p.) of the metal frame.

By comparing the expected movements of reference points with what actually occurred in succeeding frames one can assess what movement actually occurred.

Not only is it possible to assess the movement but one can, by comparison with other movements, assess the relative speed of the movement occurring. There are several movements, both voluntary and involuntary reactions to the shots, which one can use to help assess the speed of any movement occurring:-

- (1) The reaction, involuntary, of President Kennedy to the fatal shot(s) (as noted by Ray Marcus, Josiah Thompson, and Harold Weisberg, the movement of the President's head was sharply forwards between f.312 and f.313, then backwards and to (his) left between f.313 and f.319; thus indicating two shots - one at f.312-3 from behind and one at f.313-4 from front right). The car was travelling at almost exactly a right angle to Zapruder's camera in this sequence; and the distance JFK's head moved backwards (disregarding leftward movement) through f.314 to f.319 was about the same distance as from the back to the front of his head - approximately 6 inches. This movement occurs in five frames - 0.275 seconds/

seconds and is due to the impact of the bullet imparting its momentum to JFK's head.

- (2) The voluntary reaction of Clint Hill to hearing the first shot(s). S.A. Clint Hill, on the left front running-board of the follow-up car, can be seen to be facing slightly to (his) right of straight forward, in a fixed position through f.222 to f.230. At f.231 he starts to turn his head to (his) right and by f.242 he can be seen to be facing to left (i.p.) of camera but has still not turned his face into a position where it is facing at right angles to the direction of movement of the car. (e.g. he is still not facing fully to his right). Thus in 12 frames, 0.66 seconds, Hill turned his head through an angle well short of 90°. Hill's reaction was a voluntary one; he was turning to look over his right shoulder in the direction from which he believed the report of the first shot had come.

- (3) The voluntary movement of JK's right arm.

JK's right arm starts to move in f.233 (one assumes her right hand was previously resting in her lap, and from the movement this appears to be the case) and by f.244 her right hand is just reaching JFK's left elbow. This voluntary movement thus occurred in 0.61 seconds.

- (4) The voluntary reaction of JFK to being hit.

This is difficult to judge since JFK has clearly started to react before he emerges from behind the traffic sign at f.224-5. But one can get some indication of the speed of his reaction; - his left arm rises from its nearly vertical position in f.224 to a horizontal position in f.230, 0.33 seconds later. At f.224 JFK's right hand, which has come well across from its previous position/

position of elbow resting on the car-side, with the forearm moving up and down as he waved to the crowd.

How long before f.224 JFK began to react is impossible to estimate with accuracy; but to this time period must be added the time between impact and the start of the voluntary reaction (e.g. reaction time) - this also cannot be estimated accurately - in order to determine the frame at which impact occurs. Although it cannot be estimated accurately from the film it is clear that JFK was hit well before f.224. Other photographic evidence and witness testimony from Philip Willis and Hugh Betzner indicates that JFK was in fact hit at least as far back as f.200 and probably just prior to this.

no
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The following is an analysis of the frames, comparing each frame with previous frame (except, of course, f.222) in order to determine the movements which occurred. It is not a simple direct comparison but also takes into account the above mentioned relative movements, speed of movements etc. which must be borne in mind as each frame is compared with the previous frame. The comparison also takes into account the overall sequence; and so the indications of movements between frames are not just simply determined by the differences between the two frames. In reading the analysis it is necessary to bear in mind all the above mentioned factors.

222

In f.222;

JC is facing to (his) right of the camera - this is indicated by the shadow down his face; it is slightly to (his) left of midline, his nose is apparent only as a slight protrusion into the shadow side of his face. His left ear is clearly visible, his right ear is not. His head appears to be tilted very slightly backwards/

backwards (e.g. chin forwards, forehead back).

His collar and tie are presenting a square-on to camera image; about the same amounts of right and left shirt collar are visible, with the knot of the tie in the centre. The line down the inside of the right lapel of his coat is roughly parallel to the line down the edge of the road sign, as is the line down the inside of the left lapel.

The line drawn between the tips of his left and right shoulders (hereafter referred to as 'the line across his shoulders') is at about 90° to the line down the edge of the road sign. Thus the line across his shoulders is not parallel to a line horizontally across the car at 90° to the direction of movement of the car (in the following frames this line can be seen quite readily represented by the dark line across the back seat, a few inches below the top of the seat, approximately intersecting with JK's right arm at a point roughly halfway down the line down the left side (i.p.) of the arm between shoulder and elbow. But in f.222 this line across the back seat is not yet visible - a similar reference line would be the line across the top of the grill at the front of the car - the line across JC's shoulders is clearly not parallel to this reference line).

The tip of JC's left shoulder is obscured by the metal strip at the front of the glass panel. There is a small amount of JK's left arm visible beyond JC's left shoulder. The tip of (his) right shoulder is just obscured by the edge of the road sign; line down left (i.p.) JK's right arm is visible so tip of JC's right shoulder is clearly to left (i.p.) of line down JK's right arm.

The top of JC's white Texas hat is visible just above the edge of the car, to left (i.p.) of metal strip at front of glass panel./

panel. The top edge of the hat is just below the level of the hand-rail (the grey line just to left (i.p.) of the tip of Roy Kellerman's right shoulder, and to right (i.p.) of the metal strip). The amount of hat visible extends to just less than half the distance between metal strip and metal frame.

The line down the left side (i.p.) of JC's head is well to the left (i.p.) of the line down left side (i.p.) of JK's head.

All of this indicates that JC is facing to (his) right of straight forward (in direction of movement of car) and to (his) right of camera. His face is clearly turned to (his) right, as is his body - his right shoulder is obviously further (towards) back than his left shoulder. His hat is in front of him (probably in his lap, held by his right hand - see later) with the brim horizontal - the top of the hat is visible, clear from the sharp angle at its top edge and from the shadows down left side (i.p.) of the hat.

In f.223:

JC is still facing to (his) right of camera, but slightly less to (his) right than in f.222 - the shadow line down his face is slightly to (his) left of midline, less so than in f.222; his nose is protruding slightly less into the shadow side of his face, and the shadow below his nose is clearly visible defining the lower border of the nose. Left ear is still visible, as in f.222. His head is still tilted just slightly back, as in f.222.

The appearance of collar and tie are much the same as in f.222 - the metal frame is obscuring less of his left collar but the amounts visible are otherwise the same, presenting a similar square-on to camera appearance to that in f.222.

Just barely discernible below JC's right shoulder is a slightly/

slightly lighter area than the rest of the coat - this is the sun shining on a fold of cloth caused by the shoulder being at rest, with the upper arm vertically down.

The lines down the insides of right and left lapels are— still parallel to each other but are just slightly off parallel with the line down the edge of the road sign - the lower visible edge of the line down inside of each lapel is to right (i.p.) of its own top edge. By comparison with f.222 this indicates the body is now turned slightly to (his) left of square-on to camera.

The angulation of the line across the shoulders is very similar to that in f.222 - it is now just slightly less than 90° to the line of the edge of the road sign (reading angle in clockwise direction from top of edge of road sign). The line across the back seat is now visible, and it can be seen that the line across the shoulders is not parallel to the line across the back seat; and if both lines were extended they would intersect on left side (i.p.) of JC.

Tip of JC's left shoulder is all but obscured by metal frame, as in f.222; is now just fractionally to left (i.p.) of the metal frame. The length of JC's left shoulder is the same as in f.222. Less of JK's left arm is visible to right (i.p.) of JC's left arm. The angulation of the line down JC's left arm to the line of the near edge of the car is just slightly less than in f.222 (reading angle in clockwise direction from edge of car).

Tip of JC's right shoulder is still to left (i.p.) of line down JK's right arm.

Slightly more of JC's hat is visible than in f.222. It now extends halfway from metal strip to metal frame; and it is slightly higher/

higher - its top edge is now level with the hand-rail.

The line down left side (i.p.) of JC's head is still to left (i.p.) of line down left side (i.p.) of JK's head.

All of this indicates that JC has moved very little between f.222 and f.223 - he appears to have turned fractionally to his left. He is still facing to (his) right of camera, but his body appears to be just slightly to (his) left of square-on to camera whilst still facing to (his) right of straightforward, with his right shoulder back, left shoulder forward. His hat is still visible, brim horizontally placed, in front of him in a similar position to position in f.222.

In f.224:

JC is facing square-on to camera - the shadow line down his face is in the midline; sunlit part of nose does not protrude into shadow side of face. Left ear has well defined lower border - much more prominent and distinct than in f.223; the reverse is true with the top of the left ear. His head appears to be tilted not only back but is now also slightly tilted to (his) right.

Less of both right and left shirt collars are visible than in f.223; and now there is more of his left collar visible than his right collar - this is due to (his) right lapel of his coat coming across and obscuring some of the right collar. There is no white shirt visible to left (i.p.) of JC's tie and to right (i.p.) of inner line of (his) right lapel (e.g. between coat and tie on (his) right side) as there was in f.223 - again due to (his) right lapel coming across. There is still a little white shirt visible between coat and tie on (his) left side. The line down the inside of (his) right lapel is clearly nowhere near parallel/

parallel to the line of the edge of the road sign and is making a considerable angle to it, much more so than in f.223. The line down the inside of (his) left lapel has also increased its angulation to line of edge of road sign, but the increase is not as marked as with (his) right lapel.

The sunlit area on JC's right shoulder is much larger than in f.223 and is quite clear. It appears to consist of two distinct areas - one at the junction of shoulder and chest, and the other (more vertical of the two) at the junction of shoulder and arm (this is to be expected and is the natural folding pattern of clothes at the shoulder when the upper arm is at rest, vertically downwards). This indicates that JC's right shoulder has come forwards, since it is now more into the sunlight.

The angulation of line across JC's shoulders is now much less than 90° to line of edge of road sign, and is now parallel to the line across backseat. Tip of JC's left shoulder is clearly visible slightly less than halfway from metal strip to metal frame. And it is slightly higher than in f.223 - being slightly nearer to the level of the line drawn across Mrs. Connally's right shoulder than in f.223. The length of JC's left shoulder is less than in f.223. There is slightly more of JK's left arm visible to right (i.p.) of JC's left arm than in f.223. The angulation of the line down JC's left arm is much less to line of edge of car than in f.223. All of this indicates that JC's left shoulder has moved backwards, slightly upwards, and his body is slightly tilted to (his) right (this is indicated by angulation of line down (his) left arm - it is doubtful if JC's left elbow is simply rising up to (his) left since JK's left arm is visible to right (i.p.) of JC's left arm and below handrail as in f.223, indicating no movement of JC's elbow upwards and to (his) left since/

since this would obscure the above mentioned part of JK's left arm).

Tip of JC's right shoulder is less to left (i.p.) of line down JK's right arm, and it is further from line across backseat and slightly nearer to edge of car than in f.223. Length of JC's right shoulder is slightly less than in f.223. All of this indicates that JC's right shoulder has come forwards and downwards.

Not necessarily from the hat

JC's hat is not clearly visible - there is just a greyish blur in the position the hat was in at f.223; and this blur does not extend as far to left (i.p.) of metal strip as the hat does in f.223 (and there is less grey visible in f.224 than white visible in f.223). This indicates that the hat has gone to right (i.p.) of its position in f.223 - that is, the hat has moved to JC's left and/or forwards and/or downwards.

The line down left side (i.p.) of JC's head is still to left (i.p.) of line down left (i.p.) of JK's head.

All of these points indicate that JC has changed his position markedly from f.223. His face has turned to (his) left; his body has rotated to left, his right shoulder has moved forwards and downwards, his left shoulder has moved backwards and upwards; and there is a slight tilt of JC's head and body to (his) right. JC's hat has moved forwards and/or to (his) left and/or downwards.

In f.225:

JC is facing slightly to (his) left of camera but is still facing to (his) right of straight forwards - shadow line down his face is to (his) right of midline; slight amount of right side of chin is visible in sunlight, and (his) right eye is just discernible. There is also a very small sunlit area below JC's right/

right eye, slightly to left (i.p.) of his nose. Left ear is only just discernible. These points indicate that JC has turned to (his) left of his position in f.224. His head is tilted more to (his) right than in f.224.

Less of (his) right shirt collar is visible than in f.224. Slightly more of (his) left collar is visible than in f.224 (due to metal frame obscuring less of (his) left collar - this is also an indication of tilt of JC's body to (his) right).

Sunlit area on JC's right shoulder is slightly larger than in f.224 - the less vertical of the two folds is slightly larger than in f.224 and extends slightly to right (i.p.), in relation to tip of JC's right shoulder, of its position in f.224. This indicates that JC's right shoulder has moved forwards (- shoulder is less in shadow of head, more in sunlight -) of its position in f.224.

Right inner lapel line has come further across - is obscuring more of his right shirt collar; and it has increased in angulation to line of edge of road sign. Left inner lapel line has decreased in angulation to edge of road sign and is now, again, virtually parallel to line of edge of road sign.

The line across JC's shoulders has increased in angulation to line of edge of car (reading angle anti-clockwise from edge of car) and has rotated anti-clockwise through line parallel to line across backseat (position in f.224). If line across shoulders and line across back seat are extended they will intersect on right side (i.p.) of JC. Tip of JC's left shoulder is further to left (i.p.) of position in f.224 - is now more than halfway from metal strip to metal frame; is nearer to metal frame than metal strip. And tip of (his) left shoulder is higher than in f.224 - is now at same level as line drawn across Mrs. Connally's right/

right shoulder. Length of JC's left shoulder is much less than in f.224. More of JK's left arm is visible to right (i.p.) of JC's left arm. Angulation of line down JC's left arm is less to line of edge of car than in f.224. These points indicate that JC's left shoulder has moved upwards and to left (i.p.) of its position - that is, it has moved backwards and upwards.

Tip of JC's right shoulder is still to left (i.p.) of line down JK's right arm, slightly less so than in f.224; and it is slightly further from line across backseat and slightly nearer to edge of car than in f.224. Length of JC's right shoulder is slightly less than in f.224. These points indicate that JC's right shoulder has come forwards and downwards from position in f.224.

JC's hat is now visible again. It appears above the edge of the car to left (i.p.) of metal strip; it extends to just less than halfway from metal strip to metal frame, and its top edge is just level with the hand rail. It appears greyer than in f.222 and f.223 - this may be an indication that the part of the hat visible is in shadow. The hat has thus moved back and/or to JC's right and upwards slightly from its position in f.224 - but it is still not as far back and/or to JC's right and up as in f.223.

To left (i.p.) of the hat, above the edge of car and to right (i.p.) of metal frame there is a small pink area - this is JC's right hand (see later frames) holding the brim of his hat. It was not visible previously (thus has moved upwards and/or backwards).

All these points indicate that JC has again, changed his position markedly from the previous frame (f.224). His face has turned further to (his) left, and his body has further rotated to (his) left - left shoulder has gone upwards and backwards, right/

right shoulder has gone forwards and downwards. His body is clearly tilted to his right. His right hand and his hat have moved upwards and/or backwards.

f.226 is slightly blurred but most of the reference points are discernible:

JC is facing well to (his) left of camera, but is still facing to (his) right of straight forward - the shadow line down his face is clearly to (his) right of the midline, more of his right cheek is in sunlight than in f.225. Shadow of nose is just into the shadow side of face. More of (his) right side of chin is visible than in f.225. Right eye is now in sunlight. Left ear is not discernible. JC has thus turned further to (his) left from f.225. JC's head is quite clearly tilted to (his) right.

It is difficult to discern the amounts of right and left shirt collars visible due to the blurring. Similarly, the sunlit areas at (his) right shoulder are blurred and it is difficult to judge the amounts visible - but they are still visible. The inner lapel lines are obscured by the metal frame and JC's hat.

Angulation of line across shoulder is greater to both line of edge of car and line across back seat than in f.225. Tip of JC's left shoulder is now just to right (i.p.) of metal frame; it is further to left (i.p.) and higher - is now just above level of Mrs. Connally's right shoulder - than in f.225. More of JC's left arm is visible to right (i.p.) of JC's left arm than in f.225. Angulation of line down JC's left arm has decreased to line of edge of car from f.225. All these points indicate that JC's left shoulder has moved upwards and backwards, with his body tilting to (his) right, from its position in f.225.

Tip/

Tip of JC's right shoulder is still to left (i.p.) of line down JK's right arm; it is slightly further from line across backseat and nearer to edge of car than in f.225. Again, JC's right shoulder appears to be moving downwards and forwards (the tilt of JC's body to (his) right accounts for (his) turning right shoulder not moving to right (i.p.) of line down JK's right arm).

More of JC's hat is visible than in f.225. Part of it is whiter than in f.225 - indicating the appearance of a shadow line. The hat extends from metal strip to metal frame, (e.g. whole length of glass panel), and it is higher than in f.225 - its top edge is now above the level of the hand-rail, and is now between the levels of Kellerman's and Mrs. Connally's right shoulders, it is also much nearer to tip of JK's left shoulder than in f.225. The hat has, therefore, moved upwards, and backwards and/or to JC's right.

The pink of JC's right hand has moved upwards from f.225 and is now slightly to left (i.p.) of the metal frame - it is visible just below the point of intersection of JC's right inner lapel line and the metal frame. Below and to left (i.p.) of (his) right hand is a white dot, just visible above the edge of the car and slightly left (i.p.) of metal frame - this is JC's right shirt cuff (see later frames).

All these points indicate that JC has, once again, moved quite markedly from his position in the previous frame (f.225). His face has turned further to (his) left; and his body has rotated further to (his) left - his left shoulder has gone upwards and backwards, his right shoulder has moved downwards and forwards, with his body tilted slightly more to (his) right. His right hand, along with the hat it is holding, has moved upwards, and backwards and/or to (his) right.

f.227/

f.227 is very blurred but several of the reference points are still discernible:

JC has turned further to (his) left of camera - his right eye is visible in sunlight; shadow line down his face is well to (his) right of midline, and shadow of nose is almost clear of shadow side of face. Right cheek is clearly visible in sunlight. JC has thus turned to (his) left of his position in f.226 (it is difficult to tell if he is facing to (his) right or (his) left of straight forwards). The tilt of his head cannot really be judged due to the blurring.

It is difficult to judge amount of his right shirt collar visible. Left collar is not visible due to JC's chin (- head turning to (his) left -) and his right hand obscuring it. The sunlit areas at JC's right shoulder are not discernible due to the blurring.

Angulation of line across shoulders is difficult to measure due to difficulty in discerning tip of (his) left shoulder accurately. Tip of left shoulder is almost obscured by metal frame and hat, but it is probably the black image visible just above the blurred image of the hat and to right (i.p.) of the metal frame; if this is correct, it is to left (i.p.) of position in f.226 and is also higher - is now just above level of Mrs. Connally's right shoulder. And the length of (his) left shoulder is much less than in f.226. Cannot judge amount of JK's left arm to right (i.p.) of JC's left arm due to JC's hat obscuring the line down JC's left arm, but horizontal distance from tip of JC's left shoulder to right edge (i.p.) of JK's left arm is greater than in f.226. Angulation of line down JC's left arm cannot be measured due to hat obscuring almost all of the line. These points tend to indicate that JC's left shoulder has moved backwards and upwards/

upwards from its position in f.226.

Tip of JC's right shoulder is difficult to locate precisely but it is still to left (i.p.) of line down JK's right arm. Length of right shoulder is also difficult to measure but appears approximately the same as in f.226. Tip of right shoulder appears to be further from line across backseat than in f.226.

JC's hat is very blurred but it can be seen to be obscuring the line down JC's left arm and most of his left arm - tip of shoulder just visible. The top edge of the hat is now at the level of Mrs. Connally's right shoulder - is, therefore, higher than in f.226.

JC's right hand is now much higher than in f.226 - more black coat is visible between hand and edge of car; hand is now at level of JC's right shirt collar. The metal frame appears to be passing between hand and camera - most of hand is to left (i.p.) of metal frame but there is some of it visible to right (i.p.) of it. More of JC's right shirt cuff is visible and it is higher than in f.226 - more black coat between cuff and edge of car. Hat, hand, and shirt cuff have all moved upwards from positions in f.226.

All the discernible points indicate that JC has turned further to (his) left from position in f.226; his body has also rotated further to (his) left - left shoulder up and back (and right shoulder down and forwards). His right hand and hat have risen further, from position in f.226.

In f.228:

JC is facing well to (his) left of camera and is now facing to (his) left of straight forwards (e.g. facing slightly to his left) - shadow line down face is now well to (his) right of midline,/

midline, shadow of nose is not now merged with the shadow side of his face; right eye is clearly in sunlight, as is his right cheek, more so than previously. Curved shadow below (his) right side of his chin is clearly visible, and JC's right ear is discernible in the shadow side of his face. His nose is just visible in profile. Thus JC has turned further to (his) left of position in f.226 (and considerably further to (his) left of position in f.225). JC's head is tilted slightly backwards.

Very little of (his) right shirt collar is visible. Left collar is not visible - is obscured by his head (and right hand). The sunlit areas at JC's right shoulder are again visible, and are aligned nearer to horizontal than previously - indicates JC turning to (his) left (shoulder turning a position where it is nearer side-on to camera), with his right shoulder coming forwards.

Angulation of line across shoulders has increased to both line of edge of car and line across backseat from f.226 (and f.227). Tip of JC's left shoulder is now to left (i.p.) of metal frame - is just visible to right (i.p.) and below JC's nose. Tip of (his) left shoulder is also to left (i.p.) of its position in f.226 (and f.227) in relation to tip of JK's left shoulder. It is at same height as in f.227 - just above level of Mrs. Connally's right shoulder. Very little of length of JC's left shoulder is visible due to head obscuring it - tip is just visible. As in f.227, JC's hat is obscuring the line down (his) left arm and thus one cannot judge amount of JK's left arm to right (i.p.) of (his) left arm (but horizontal distance from tip of (his) left shoulder to right edge (i.p.) of JK's left arm is greater than in f.227) and also cannot measure angulation of line down (his) left arm. All of these points indicate that JC's left shoulder is still moving backwards as his body turns to (his) left.

Length/

Length of JC's right shoulder has shortened considerably between f.227 and f.228. Tip of (his) right shoulder has moved to right (i.p.) of its position in f.226 (and f.227) - it is now to right (i.p.) of line down JK's right arm; and it is further from line across back seat. The red roses at JK's right elbow are now visible and tip of JK's right elbow is coming into view. These points indicate that JC's right shoulder has moved forwards (and downwards) from its position in f.227.

JC's hat is clearly visible, especially the whiter top part of it. It is slightly higher than in f.227 - top edge is above the level of Mrs. Connally's right shoulder. The hat also appears to be left (i.p.) of its position in f.226 - there is a larger black area between the hat and the metal strip to right (i.p.) of it. There are one or two grey dots visible, through the glass panel, below the white top of hat - these may be part of the brim of the hat in sunlight; if so this shows that the hat is not horizontal as in f.222 and f.223 and is inclined slightly. The hat has thus moved slightly upwards, and backwards and/or to JC's right.

JC's right hand has risen up from its position in f.227 - its top edge is now at the level of his chin and is obscuring a little of JC's right shirt collar. Hand is still mainly to left (i.p.) of the metal frame. More of JC's right shirt cuff is visible and it is slightly higher - a little more black coat visible between cuff and edge of car - than in f.227. Thus hat, hand, and shirt cuff have risen up slightly, and have also moved slightly backwards and/or to (his) right.

Line down left side (i.p.) of JC's head is still to left (i.p.) of line down left (i.p.) of JK's head. (Compare this slight, if any, movement of line down left side (i.p.) of JC's head/

head in relation to line down left side (i.p.) of JK's head between f.223 and f.228 with the movement of the line down left side (i.p.) of Kellerman's head in relation to line down left side (i.p.) of Mrs. Connally's head between f.223 and f.228 - line down Kellerman's head has moved from slightly left of line down Mrs. Connally's head in f.223 to slightly to right of it in f.228. This movement in relations of Kellerman and Mrs. Connally is due to the movement of the car (there being little movement by either Kellerman or Mrs. Connally) - the lack of movement of JC's head in relation to JK's head is partially explained by JC's head turning to (his) left but also by JC's head tilting to (his) right.)

All of the points indicate that JC has turned further to his left than in f.227; and is now facing to (his) left of straight forwards. His body has rotated further to (his) left, left shoulder going back, right shoulder going forwards (and downwards). The shortened length of both shoulders, and the horizontal nature of the sunlit areas at (his) right shoulder, indicate that JC is approaching a side-on position to camera - tip of right shoulder is just to left (i.p.) of line down left side (i.p.) of JC's head. JC's hat and (his) right hand have risen slightly further and have moved slightly backwards and/or to JC's right.

In f.229:

There is very little change in JC's head from f.228 - JC is still facing to (his) left of straight forwards just slightly to (his) right of his position in f.228 (e.g. is turned slightly less to (his) left than in f.228) - shadow line down face is just slightly nearer to midline than f.228, is nearer to his right eye; slightly less of curvature below (his) right side of chin/

chin than in f.228, and his nose is less pronounced in profile than in f.228. JC's head is not so tilted back as in f.228; and chin is further to left (i.p.) of metal frame than in f.228 - chin has moved back and/or to (his) right (from f.222 to f.228 his chin moved nearer to metal frame - now reverse action taking place).

Slightly more of JC's right collar is visible than in f.228 - partially due to (his) right hand moving down, obscuring less of collar. Left collar is not visible. Sunlit areas at right shoulder are presenting a similar image to that in f.228 - still almost horizontally aligned. These points indicate that JC's body is still near to side-on to camera.

Angulation of line across shoulders has now decreased slightly to line of edge of car from f.228. Tip of JC's left shoulder is now just obscured by metal frame - has thus moved to right (i.p.) - e.g. has moved forwards of position in f.228. It is at same height as in f.228 - still just above level of Mrs. Connally's right shoulder. Slightly more length of JC's left shoulder is visible than in f.228. Line down JC's left arm is still obscured by JC's hat (shadow down hat gives false impression of JC's left arm) thus cannot judge the amount of JK's left arm to right (i.p.) of JC's left arm (horizontal line from tip of left shoulder to right edge (i.p.) of JK's left arm is less than in f.228) and cannot measure angulation of line down JC's left arm. These points indicate that JC's left shoulder has moved slightly forwards from its position in f.228.

Length of JC's right shoulder has increased just slightly from f.228. Same amount of roses are visible as in f.228. Tip of JK's right elbow is just visible. Tip of (his) right shoulder/

shoulder is slightly nearer to edge of car than in f.228. The points indicate that there is very little change in the position of JC's right shoulder, only a slight movement downwards and backwards and/or to JC's right.

JC's hat has moved downwards and to right (i.p.) from f.228 - its top edge is now just below level of Mrs. Connally's right shoulder; and the whiter part (in sunlight) is now extending about halfway from metal strip to metal frame (in f.228 it extended halfway from metal frame to metal strip - reverse of situation in f.229). More of line down JC's left arm is visible than in f.228 - hat is obscuring less of it. These points indicate that the top of his hat has moved downwards, forwards and/or to JC's left.

JC's right hand is (now clearly discernible) visible just below his chin. The metal frame is between hand and camera, but much more of hand is visible to left (i.p.) of metal frame than to right (i.p.) of it. Hand is lower than in f.228 - is obscuring less of right collar and now black coat is visible between chin and hand. Less of right shirt cuff is visible than in f.228, and it is slightly lower than in f.228 - less black coat visible between cuff and edge of car. Right hand and shirt cuff have thus moved downwards slightly.

Line down left side (i.p.) of JC's head is still to left (i.p.) of line down left side (i.p.) of JK's head.

All the points of reference seem to indicate very little change in JC's position between f.228 and f.229. He has turned fractionally to (his) right (he has clearly stopped turning to (his) left); his left shoulder has moved forwards, his right shoulder has moved slightly downwards, and backwards and/or to JC's right. His body appears to be rotating to (his) right.
His/

His right hand and his hat have moved slightly downwards.

In f.230:

JC is still facing to (his) left of camera; - is facing slightly less to (his) left than in f.229 (e.g. he has turned fractionally to (his) right of position in f.229) - the shadow line down his face is nearer to midline than in f.229, is now encroaching upon his right eye. Less of his right cheek is visible in sunlight, and less of curvature below right side of chin, than in f.229. Nose is less discernible in profile than in f.229. Right ear is still discernible. Head is tilted slightly less backwards than in f.229; and is now almost vertical - chin is slightly further from metal frame than in f.229, more black coat between chin and metal frame.

Slightly more of (his) right shirt collar is visible than in f.229. Sunlit areas at JC's right shoulder are still visible, but are smaller than in f.229 and do not extend as far to right (i.p.) as in f.229. This indicates that JC's right shoulder is moving backwards.

Angulation of line across his shoulders is same as in f.229. Tip of (his) left shoulder is obscured by metal frame - thus it has moved slightly forwards from f.229 (if (his) left shoulder was stationary tip of it would move back, e.g. to left (i.p.), from metal frame as film progresses frame by frame). Tip of (his) left shoulder is at same height as in f.229 - just above level of tip of Mrs. Connally's right shoulder. Length of JC's left shoulder is slightly greater than in f.229. Cannot compare amount of JK's left arm visible to right (i.p.) of JC's left arm with that in f.229 due to hat obscuring view in f.229, but horizontal distance from tip of JC's left shoulder to right edge (i.p.) of JK's left arm is less than in f.229. Can now measure angulation/

angulation of line down JC's left arm but cannot compare with f.229 due to hat obscuring most of line from view in f.229. These points indicate that JC's left shoulder has moved forwards from f.229.

Length of JC's right shoulder is slightly greater than in f.229. Tip of right shoulder is slightly nearer to edge of car than in f.229 and it is slightly to left (i.p.) of position in f.229 - slightly less of roses visible than in f.229. JK's right elbow is just visible. These points indicate that JC's right shoulder has moved slightly downwards, backwards and/or to (his) right of its position in f.229.

JC's hat is now quite clearly discernible - the brim of hat is visible, line of brim is approximately parallel to line of edge of car; brim is just below level of JC's chin and just above level of tip of Kellerman's right shoulder, and it extends from metal frame to metal strip. The top of the hat is visible, just above edge of car to right (i.p.) and below the fingers of (his) right hand, to right (i.p.) of metal frame. The part of the hat between top and brim is in shadow. Top edge of hat is lower than in f.229 - is now well below tip of Mrs. Connally's right shoulder and just below level of JC's chin. JC's right hand is lower than in f.229 - more black coat between hand and chin. Metal frame is still between hand and camera - still more of hand is to left (i.p.) of metal frame than to right (i.p.) of it. Top edge of hand is lower than in f.229 in relation to (his) right shirt collar - was well above level of bottom of collar in f.229, is now just above this level of bottom of collar. Less of (his) right shirt cuff is visible than in f.229, ~~is~~ ~~is~~ - less black coat between cuff and edge of car - and is beginning to be obscured by edge of car. These points indicate that (his) right/

right hand has moved downwards from f.229. The hat appears to have rotated - top of hat visible in previous frames has moved down and left (i.p.), brim is clearly visible for first time - ; thus hat has rotated over into a more vertical position - e.g. brim of hat is more vertically aligned, with top of hat to (his) right or right front of brim.

Line down left side (i.p.) of JC's head is now just slightly to left (i.p.) of line down left side (i.p.) of JK's head.

These points indicate that there has been a more marked change in position between f.229 and f.230 than there was between f.228 and f.229 - JC has turned slightly more to (his) right of his position in f.229 and is now facing just slightly to (his) left of straight forwards. His body has rotated more to (his) right - his right shoulder is moving down and backwards, (his) left shoulder is moving forwards. His left shoulder is higher than his ~~left~~^{right} shoulder indicating his body is tilted to (his) right. His right hand has moved downwards and the hat, which is also lower than in f.229, has rotated so that the brim is in a more vertical position.

In f.231:

JC has turned slightly more to (his) right of position in f.230 - shadow line down his face is nearer midline, is now encroaching well into (his) right eye; less of cheek is in sunlight than in f.230. Shadow of nose is nearer to shadow side of face. Less of curvature below (his) right side of chin is visible than in f.230. Head now appears to be tilted slightly ^{forwards of} further from metal frame than in f.230, slightly more black coat between chin and metal frame; but top of JC's head on right side (i.p.) is obscuring more of JK's hair and more of JK's left blue/

blue collar than in f.230.

Same amount of JC's right shirt collar is visible (perhaps a little less, - due to (his) right hand obscuring a little of it) as in f.230. Left collar is still not visible, and tie not discernible. Sunlit areas at JC's right shoulder are only vaguely visible, less visible than in f.230 and do not extend as much to right (i.p.) as in f.230.

Angulation of line across shoulders has slightly decreased to line of edge of car from f.230. Tip of (his) left shoulder is still obscured by metal frame and is at same ^{height} as in f.230. Length of (his) left shoulder has slightly increased from f.230, and less of JK's left arm is visible to right (i.p.) of JC's left arm than in f.230. Angulation of line down JC's left arm is less to line of edge of car than in f.230. These points indicate that JC's left shoulder has moved forwards; and JC's body is tilting to (his) right and/or JC's left elbow is moving upwards and/or forwards.

Length of JC's right shoulder has increased slightly from f.230. Tip of (his) right shoulder is slightly nearer to edge of car and is to left (i.p.) of its position in f.230 - much less of roses visible, now virtually obscured by JC's right shoulder, than in f.230. Less of JK's right elbow is visible than in f.230. These points indicate that JC's right shoulder has moved downwards, and backwards and/or to JC's right from f.230.

JC's hat is now clearly rotating: less of hat is visible than in f.230, line of brim is no longer parallel to line of edge of car and is now making a quite definite angle to line of edge of car - highest part of brim (that part at extreme left (i.p.) of glass panel, just to right (i.p.) of metal frame) is at just a slightly/

slightly higher position than in f.230. The lowest, most forward, part of brim (that part at extreme right (i.p.) of glass panel, just to left (i.p.) of metal strip) is now just above junction of edge of car and metal strip. Thus the most forward part of brim has moved downwards and/or to JC's right and/or backwards - e.g. it has rotated over more into a vertical position and front edge is moving round to JC's right, more so than back edge. Part of brim may be visible just below JC's right hand, just above edge of car and to left (i.p.) of metal frame. Top of hat is not now visible, a further indication that the hat is rotating (putting top of hat into shadow); and hat is moving downwards and to JC's right - thus top of hat moving out of view. And more of JC's left arm is visible to right (i.p.) of hat, this also indicates rotation of hat and the movement to JC's right end/or backwards.

Much more of JC's right hand is visible to left (i.p.) of metal frame than in f.230 and less of hand is visible to right (i.p.) of metal frame than in f.230. Shadow line down (his) right hand is now to left (i.p.) of extreme right (i.p.) point of JC's right shirt collar, was to right (i.p.) of this point in f.230. Hand is lower than in f.230 - top edge of hand is now at level of bottom edge of JC's right collar, and bottom edge of hand is nearer to edge of car than in f.230. Less of JC's right shirt cuff is visible than in f.230 - is now virtually no black coat between it and edge of car, and some of cuff is obscured by edge of car. Shirt cuff is further to left (i.p.) of metal frame than in f.230. These points indicate that (his) right hand has moved downwards, and to (his) right and/or backwards from f.230.

Line down left side (i.p.) of JC's head is now virtually in line/

line with, fractionally to left (i.p.) of, line down left side (i.p.) of JK's head.

All of these points indicate that JC has turned further to (his) right from f.230. He is facing straight forward or — fractionally to (his) left of straight forward. His head has tilted slightly forwards. His body has turned more to (his) right than has his head - his right shoulder has moved back and down, left shoulder has moved forwards. His body appears to be tilting to (his) right. His right hand is moving downwards, and backwards and/or to (his) right; his hat is rotating over and round and is moving backwards and/or to (his) right.

In f.232:

JC is still facing approximately straight forward; is facing just slightly more to (his) right than in f.231 - shadow line down face is just slightly nearer midline, shadow of nose is now just merging with shadow side of face, and curvature of (his) left side of his chin is now visible. His head is tilted forwards as in f.231.

More of JC's right shirt collar is visible than in f.231. Tie is not really discernible, and left collar is not visible. Sunlit areas at right shoulder are not visible. Angulation of line down inside of (his) right lapel has increased to line of edge of car from f.231.

Angulation of line across shoulders is same to line of edge of car as in f.231. Tip of (his) left shoulder is still obscured by metal frame, and is at same height as in f.231. Length of (his) left shoulder visible is slightly less than in f.231 - due to turning of head; (his) left side of face, below nose is now visible. Same amount of JK's left arm is visible to right (i.p.) of JC's left arm. Angulation of line down JC's left arm is slightly/

slightly less to line of edge of car than in f.231. These points indicate that JC's left shoulder is moving forwards; and that (his) left elbow is moving forwards and/or upwards and/or JC's body is tilting to (his) right.

Length of JC's right shoulder is greater than in f.231. Tip of (his) right shoulder is nearer to edge of car and further to left (i.p.) than in f.231 - virtually none of roses are visible to left (i.p.) of JC's right shoulder, less than in f.231. Tip of JC's right shoulder is now to left (i.p.) of line down JK's right arm. JK's right elbow is not now visible. Line down JK's right arm, as it has been from f.222, is vertical (virtually parallel to line down edge of road sign) and is making same angle to line across back seat as it has been from f.222. These points indicate that JC's right shoulder has moved downwards, and backwards and/or to (his) right, as do the above mentioned points about his right collar, inner lapel line, and disappearance of sunlit areas at (his) shoulder.

Less of hat is visible than in f.231; angulation of line of brim is less to line of edge of car than in f.231. Highest part of brim is lower than in f.231 - is now below level of tip of Kellerman's right shoulder. Lowest part of brim is lower than in f.231 - is nearer to edge of car and further below level of tip of Kellerman's right shoulder. More of JC's left arm is visible to right (i.p.) of brim of hat than in f.231. A little of brim of JC's hat is visible below JC's hand, above edge of car, and it is more to left (i.p.) of metal frame than in f.231. These points indicate that the hat is still rotating and is moving downwards, and back and/or to (his) right.

All of JC's right hand that is visible is to left (i.p.) of metal/

metal frame - none to right (i.p.) of it - and it is lower than in f.231, slightly more black coat between hand and chin. Less of right shirt cuff is visible - almost all of it is obscured below edge of car - than in f.231. These points indicate that JC's right hand is moving down and back and/or to JC's right.

Line down left side (i.p.) of JC's head is now in line with line down left side (i.p.) of JK's head.

These points indicate that JC has turned slightly to (his) right from f.231. His body has rotated further to (his) right, right shoulder moving back and down, left shoulder moving forward. And his body is tilting to (his) right. JC's right hand is moving down and back. His hat is moving down, and back and/or to (his) right, and is rotating further over and round (e.g. top of hat is going down, back, and to JC's right).

In f.233:

JC is still facing straight forwards (or slightly to (his) left of straight forwards), but has turned fractionally more to (his) right from f.232 - shadow line down face is slightly nearer to midline, very little of (his) right cheek is in sunlight, nose shadow is merged into shadow side of face, less of curvature below (his) right side of chin is visible than in f.232. Left side of chin is less curved than in f.232 - face tending to narrow and elongate below nose. Head is tilted less forwards than in f.232.

More of his right shirt collar is visible than in f.232. Tie is not clearly discernible and left collar is not visible. Sunlit areas at (his) right shoulder are not visible. Angulation of (his) right inner lapel line is greater to line of edge of car than in f.232. These points indicate that JC's right shoulder is moving back and to JC's right.

Angulation/

Angulation of line across shoulders is slightly less to line of edge of car than in f.232. Tip of (his) left shoulder is still obscured by metal frame, is just slightly lower than in f.232 - now just below level of Mrs. Connally's right shoulder. Length of JC's left shoulder is slightly greater than in f.232 (due to turning of head to (his) right, elongation of his face, as well as (his) left shoulder moving forwards as JC rotates to (his) right). Less of JK's arm is visible to right (i.p.) of JC's left arm than in f.232. Angulation of line down JC's left arm is less to line of edge of car than in f.232. These points indicate that JC's left shoulder is moving forwards, with his body tilting to (his) right and/or his left arm (and elbow) is rising up and forwards.

Length of (his) right shoulder is slightly greater than in f.232. Tip of (his) right shoulder is nearer to edge of car and further to left (i.p.) than in f.232 - none of roses visible to left (i.p.) of JC's right shoulder. Line down JK's right arm is not as near vertical as in f.232 (and previously), it is now making less of an angle to line across back seat than in f.232. Even so JC's right shoulder is still obscuring JK's right elbow. These points indicate that JC's right shoulder is still moving down, back and/or to JC's right.

Less of JC's hat is visible than in f.232; angulation of line of brim of hat is much greater to line of edge of car. Highest part of hat is lower than in f.232 - is much nearer to edge of car and is further below level of tip of Kellerman's right shoulder. Lowest part of brim visible is not now on extreme right (i.p.) of glass panel - it is about halfway from metal frame to metal strip, is thus further to left (i.p.) than in f.232. More of JC's left arm is visible to right (i.p.) ^{of hat} than in f.232. A little of JC's hat is still visible below JC's right/

right hand, and it is to left (i.p.) of position in f.232. These points indicate that JC's hat has moved down and back and/or to (his) right. It is still rotating - front edge of brim moving to (his) right faster than back edge.

Less of (his) right hand is visible than in f.232 - a little of it is obscured below edge of car. Hand is lower - more black coat between top edge of hand and his chin - than in f.232. Hand is also to left (i.p.) of position in f.252 - a small black area is visible to right (i.p.) of hand and to left (i.p.) of metal frame, just above edge of car. Less of JC's right shirt cuff is visible than in f.232, there is now very little visible above the edge of the car. These points indicate that JC's hand is moving down, and back and/or to (his) right.

Line down left side (i.p.) of JC's head is in same position as in f.232 in relation to line down left side (i.p.) of JK's head - is in line with it.

Less of JK's left blue collar is visible than in f.232.

These points indicate that JC has turned slightly to (his) right of position in f.232 and is now facing virtually straight forwards. His body is turned more to (his) right than in f.232; his left shoulder is moving forwards, left arm (and elbow) is rising up and/or forwards, and his body is tilting to (his) right. His right shoulder is moving back, down, and round to (his) right. His right hand, holding his hat, is moving back, down, and/or to (his) right. The hat is also (still) rotating.

In f.234: (although this frame is blurred it is still possible to discern most of the reference points)

JC is facing slightly to (his) right of position in f.233 and also is, now, facing slightly to (his) right of straight forwards/

forwards - very little of (his) right cheek is in sunlight, there is no curvature of shadow below (his) right side of chin. His left eye is vaguely discernible. (His) left side of his face is showing little curvature of chin - indicating face is elongating. It is difficult to judge the tilt of his head.

More of JC's right collar is visible than in f.233. Tie is vaguely discernible - greyish area just to left (i.p.) of (his) left lapel, just above (his) right hand. Angulation of line down (his) right inner lapel has decreased slightly to line of edge of car from f.233. These points indicate that JC is still turning to (his) right, the angulation of the inner lapel line indicating JC has turned beyond square-on to camera.

Angulation of line across shoulders is slightly less to line of edge of car than in f.233. Tip of (his) left shoulder is still obscured by metal frame, is at same height as in f.233. Length of (his) left shoulder is fractionally less than in f.233, and more of JK's left arm is visible to right (i.p.) of JC's left arm than in f.233. Angulation of line down JC's left arm is greater to line of edge of car than in f.233. Less of JC's left arm is visible to right (i.p.) of his hat, which is itself lower, than in f.233. All of these points indicate that JC's left shoulder has just passed the position of square-on to camera, (his) left elbow (and arm) moving down, and to JC's right and/or backwards.

Length of JC's right shoulder is a little less than in f.233. Tip of JC's right shoulder is slightly further from edge of car than in f.233; and is to right (i.p.) of its position in f.233, red roses at JK's right elbow are now vaguely visible. JK's right elbow is now visible rising to (her) right; angulation of line/

line down JK's right arm is less to line across back seat than in f.233. These points indicate that JC's right shoulder, as with his left shoulder, has just passed the position of square-on to camera. His body is still tilting to (his) right.

Much less of hat is visible, through glass panel, than in f.233; now just brim of hat visible - little or none of top side of hat in shadow is visible; the brim is much lower than in f.233 - it now occupies the angle between metal frame and edge of car. A little of brim is visible to right (i.p.) of JC's hand, and to left (i.p.) of metal frame. These points indicate that his hat has rotated further and has moved down, and to JC's right and/or backwards.

Less of JC's right hand is visible, more is obscured by edge of car, than in f.233, and it is lower than in f.233 - more black coat is visible between top edge of hand and his chin. His right hand is to left (i.p.) of its position in f.233 - shadow line down hand is to left (i.p.) of its position in f.233 in relation to line down left side (i.p.) of JC's head, and to car door-handle below and to left (i.p.) of JC's right hand. His right shirt cuff is now completely obscured below edge of car. These points indicate that JC's right hand has moved down, and back and/or to (his) right.

Line down left side (i.p.) of JC's head is now just slightly to right (i.p.) of line down left side (i.p.) of JK's head. Less of JK's left blue collar is visible to right (i.p.) of JC's head than in f.233.

JC's hair at (his) right rear of his head is slightly elevated. Elongation of JC's face in this frame (see above) indicates that JC's mouth is opening.

These/

These points indicate that JC has turned slightly to (his) right from f.233. His head is now facing straight forwards; his body has just passed position of square-on to camera - indicated especially by the shortening in length of both his shoulders. His right shoulder is going back and round to (his) right (this movement means JC's right shoulder is now moving away from edge of car, and it is, therefore, difficult to judge if the shoulder is moving downwards simply from distance of tip of shoulder to edge of car - other factors must also be taken into account in assessing downward movement of shoulder. But if the shoulder was merely moving away from edge of car with no downward movement one would expect the tip of the shoulder to move further away from edge of car in succeeding frames). JC's left shoulder is still moving forwards despite his body having gone past square-on position to camera - this indicates that his body has not yet reached side-on position to camera. His left arm is moving to JC's right and/or backwards and/or downwards. His body is still tilting to (his) right. His right hand and hat are moving down, and back and/or to JC's right.

In f.235:

JC is facing to (his) right of straight forward, to (his) right of his position in f.234 - (his) left eye is now more clearly discernible; very little of (his) right cheek is in sunlight, less than in f.233 (and f.234); shadow line down face is slightly nearer to midline than in f.234. None of his chin is now in sunlight. (His) left side of his face to right (i.p.) of his nose is just visible, sunlit. His head is apparently tilted slightly forwards, but this may be due to elongation of his face.

A little less of JC's right shirt collar is visible than in f.234. His tie is, again, just discernible, as in f.234. Left collar/

collar is not visible. Angulation of (his) right inner lapel line is slightly increased ~~from~~ to line of edge of car from f.234. These points indicate that JC's right turn is continuing, right shoulder moving round and away from camera (and edge of car).

Angulation of line across shoulders is less to line of edge of car than in f.234. Tip of (his) left shoulder is still obscured by metal frame, and is at same height as in f.234. Length of (his) left shoulder visible has increased slightly from f.234 - this is due to turning of his head to (his) right and the elongation of his face (on (his) left side). Slightly more of JK's left arm is visible to right of JC's left arm than in f.234. The angulation of line down JC's left arm is greater to line of edge of car than in f.234. These points show that JC's left shoulder is still moving forwards, and round towards camera (and edge of car); and that his left arm (and elbow) is going down and/or backwards and/or to JC's right (nearer to edge of car).

Length of JC's right shoulder is less than in f.234; tip of (his) right shoulder is further to right (i.p.) of position in f.234, more roses are visible than in f.234. Tip of (his) right shoulder is about same distance from edge of car as in f.234. JK's right arm has risen up further to her right; angulation of line down arm has decreased to line across back seat and her right elbow is clearly visible. These points show that JC is still turning to (his) right, has turned further beyond square-on position, with his right shoulder moving down, back and round away from camera (and edge of car).

Less of JC's hat is visible than in f.234; very little is visible to right (i.p.) of metal frame, less than in f.234. More of hat is visible to left (i.p.) of metal frame than in f.234.

Level/

Level of top edge of hat is lower than in f.234 - is nearer to edge of car, and now well below level of left edge (i.p.) of handrail. These points indicate that JC's hat is moving down, and back and/or to (his) right.

Less of JC's hand is visible than in f.234 - more obscured below edge of car; and it is lower - top edge is lower than in f.234, as with hat, and it is to left (i.p.) of its position in f.234. Shirt cuff is not visible. These points indicate that JC's right hand is moving back, down and/or to (his) right.

Line down left side (i.p.) of JC's head is more to right (i.p.) of line down left side (i.p.) of JK's head than in f.234.

More of JK's left blue collar is visible than in f.234.

JC's hair is quite clearly rising up at (his) right rear of his head. JC's face is more elongated than in f.234; line down (his) left side of face, below his nose, is longer and straighter than in previous frames - indication of mouth opening.

These points indicate JC has definitely turned past square-on to camera position - he is facing more to (his) right than in f.234; his right shoulder is moving down, back and away from camera; left shoulder is moving forwards, and round towards camera, with his body tilting to (his) right. His right hand and his hat are moving down, back and/or to JC's right. His hair is starting to rise up and his mouth is beginning to open.

In f.236:

JC is facing more to (his) right of straight forwards than in f.235 (he is still facing to (his) left of camera) - more of (his) left cheek is visible, in sunlight; his left eye is clearly visible. Less of (his) right cheek is in sunlight, shadow line down/

down face is nearer to midline, than in f.235. His head appears to be tilted forwards, but, again, this may be due to elongation of his face.

Slightly less of (his) right shirt collar is visible than in f.235. The grey of his tie is still discernible. Left collar is not visible. Angulation of (his) right inner lapel line is greater to line of edge of car than in f.235. These points indicate that JC's right shoulder is still moving round away from camera.

Angulation of line across shoulders is same to line of edge of car as in f.235. Tip of JC's left shoulder is still obscured by metal frame, and is slightly higher than in f.235 - is slightly nearer to level of Mrs. Connally's right shoulder. Length of (his) ~~right~~^{left} shoulder has increased just slightly from f.235. Just slightly more of JK's left arm is visible to right (i.p.) of JC's left arm than in f.235. Angulation of line down JC's left arm has increased to line of edge of car. These points indicate that JC's left shoulder is still moving forwards and round towards camera; and that (his) left arm (and elbow) is moving down and/or back and/or to (his) right.

Length of JC's right shoulder has decreased slightly from f.235. Tip of (his) right shoulder is slightly further from edge of car than in f.235 and is to right (i.p.) of its position in f.235. More of roses are visible than in f.235. (line down JK's right arm is angled less to line across back seat and more of her right elbow is visible than in f.235). These points indicate that JC's right shoulder is still moving round away from camera.

None of JC's hat is visible through glass panel. The small amount/

amount of hat visible is just above edge of car to left (i.p.) of metal frame. It is lower than in f.235 - more black coat between hat and chin - and no hand is visible between hat and edge of car. Less of (his) right hand is visible than in f.235, it is lower - more black between hand and chin -, and it is to left (i.p.) of its position in f.235 - more to left (i.p.) of metal frame and hat is now visible between hand and metal frame. These points indicate that JC's hat and (his) right hand are moving down, back and/or to JC's right.

Line down left side (i.p.) of JC's head is still to right (i.p.) of line down left side (i.p.) of JK's head, but slightly less so than in f.235. More of JK's left blue collar is visible than in f.235.

JC's hair has risen up more at (his) right rear of his head from f.235. JC's face is more elongated than in f.235 - (his) left side of face, below nose, is longer - and mouth is discernibly open - is the dark brown area below his nose.

These points indicate that JC has turned further to (his) right from f.235. His right shoulder is moving back round, away from camera, (and down); his left shoulder is moving forwards, and round towards camera, (and up), with his left arm (and elbow) moving down and/or back and/or to (his) right. He is facing to (his) right of straight forward, and his body is tilting to (his) right (this is indicated by more of JK's left blue collar being visible). His hat and (his) right hand are moving down, back and/or to (his) right.

In f.237:

JC is facing more to (his) right of straight forwards than in f.236, still facing to (his) left of camera, - less of (his) right/

right cheek is sunlit, more of (his) left cheek is visible, than in f.236. His left eye is more clearly visible than in f.236. His head is tilted to (his) right.

Slightly less of JC's right shirt collar is visible than in f.236. His grey tie is clearly visible, more so than previously. His left collar is not visible.

Angulation of line across shoulders is slightly less to line of edge of car than in f.236. Tip of JC's left shoulder is still obscured by metal frame, and is at same height as in f.236. Length of JC's left shoulder has increased slightly from f.236 (due to: JC's head turning to (his) right, falling to (his) right, and face elongating). Same amount of JK's left arm is visible to right (i.p.) of JC's left arm as in f.236. Angulation of line down JC's left arm has increased slightly to line of edge of car from f.236. These points indicate that JC's left shoulder is still moving forwards and round towards camera, left arm and elbow moving back and/or to (his) right and/or down. His body is still tilting to (his) right.

Length of JC's right shoulder has decreased from f.236. Tip of (his) right shoulder is about same distance from edge of car as in f.236, but is more to right (i.p.), more roses are visible than in f.236. (JK's right hand (white glove) is now visible; almost all of her right arm is visible). These points indicate that JC's right shoulder is moving down and back round away from camera.

A little less of JC's hat is visible above edge of car and it is slightly lower than in f.236. And a little less of (his) right hand is visible than in f.236. These points indicate that hat and (his) right hand are moving downwards (and back and/or to (his) right).

Line/

Line down left side (i.p.) of JC's head is now just to left (i.p.) of line down left side (i.p.) of JK's head. A little more of JK's left blue collar is visible than in f.236. These points indicate that JC is falling to (his) right.

JC's hair is more clearly risen up than in f.236. His face is quite definitely elongated, with his mouth clearly open.

These points indicate that JC is still turning to (his) right - he has turned more to (his) right than in f.236; he is still facing to (his) left of camera, but well to (his) right of straightforward. His right shoulder is moving down, back and round away from camera (and edge of car), his left shoulder is moving forwards and round towards camera. His body and head are tilting (and falling) to (his) right. His hat and right hand have moved only slightly downwards from f.236. His mouth is open and his hair at right rear of his head has risen up.

In f.238:

JC is facing more to (his) right of straight forward than in f.237 - there is now just a slight amount of (his) right cheek in sunlight, less than in f.237; shadow line down face is nearer to midline; more of (his) left side of his face is visible, and nose and left eye are nearer to centre of facial image, than in f.237. His head is tilted more to (his) right than in f.237.

Less of JC's right shirt collar is visible than in f.237. Grey of his tie is still discernible; but no left collar visible - due to left lapel of coat obscuring it.

Angulation of line across shoulders is just slightly more to line of edge of car than in f.237. Tip of JC's left shoulder is still obscured by metal frame, and it is at same height as in f.237. Length of (his) left shoulder is greater than in f.237 - due/

due to his head turning to (his) right. Same amount of JK's left arm is visible to right (i.p.) of JC's left arm as in f.237. Angulation of line down JC's left arm is just slightly greater to line of edge of car than in f.237. These points indicate that JC's left shoulder is still moving forwards and round towards camera.

Length of JC's right shoulder is same as in f.237. Tip of his right shoulder is just slightly nearer to edge of car than in f.237 and is more to right (i.p.) of position in f.237 - more of roses visible. (JK's right arm is fully visible, a little of her right hand is still obscured). These points indicate that JC's right shoulder has moved slightly down, back and round away from camera.

A little less of hat and (his) right hand are visible above edge of car than in f.237. There is now a small amount of black coat visible between hat and metal frame. These points indicate that JC's hat and right hand have moved very slightly down and back.

Line down left side (i.p.) of JC's head is slightly more to left (i.p.) of line down left side (i.p.) of JK's head than in f.237. Slightly more of JK's left blue collar is visible than in f.237. These points indicate that JC is falling to (his) right.

JC's hair has risen even more from his head than in f.237. JC's mouth is still open, but the horizontal shadow from mouth to right edge (i.p.) of (his) left cheek and the profile down right side (i.p.) of his face indicate that his left cheek is puffed out (due to air being forced out rapidly).

These points indicate that JC has turned just slightly further/

further to (his) right from f.237. He is facing further to (his) right of straight forward; body turned just slightly more round to (his) right; his right shoulder going down and back round away from camera, his left shoulder moving forwards, with his body tilting and falling to (his) right. His hat and his right hand have moved very slightly down and back. His hair has risen up further, and his mouth open, his cheeks puffed out.

In f.239:

JC is facing more to (his) right than in f.238 -, is now facing only just to (his) left of camera - the shadow line down his face is almost at midline, with only a tiny amount of (his) right cheek in sunlight. More of (his) left side of his face is visible than in f.238. His head is tilted to (his) right, more so than in f.238.

Less of (his) right shirt collar is visible than in f.238, as it moves round behind his head and neck as he continues his right turn. Tie is still discernible, but no left collar is visible.

Angulation of line across shoulders is slightly greater to line of edge of car than in f.238. Tip of (his) left shoulder is still obscured by metal frame, and is just slightly higher, relative to level of Mrs. Connally's right shoulder, than in f.238. Length of (his) left shoulder is same as in f.238 - his head is still turning to (his) right, but now left shoulder (and arm) is about side-on to straight forwards (there is a lightish area down JC's left arm - sunlit area). Angulation of line down JC's left arm is slightly less to line of edge of car than in f.238. Slightly less of JK's left arm is visible to right (i.p.) of JC's left arm. These points indicate that JC's left shoulder has moved very slightly forwards and round towards camera, in continuing/

continuing the turn; shoulder and arm are now approximately side-on to straight forwards, his body tilted to (his) right. His body may also be falling slightly back towards Mrs. Connally.

Length of JC's right shoulder is slightly less than in f.238. Tip of (his) right shoulder is slightly further from edge of car and to right (i.p.) of its position in f.238. Slightly more roses are visible than in f.238. These points indicate that JC's right shoulder is moving back round away from camera (and down).

Same amounts of hat and JC's right hand are visible as in f.238. And are in virtually the same position.

Line down left side (i.p.) of JC's head is slightly less to the left (i.p.) of line down left side (i.p.) of JK's head than in f.238. Slightly more of JK's left blue collar is visible than in f.238. These points indicate that JC is still falling to (his) right, but is now starting to fall back slightly.

JC's hair is risen away from (his) right rear of his head to same extent as in f.238. JC's mouth is still open, and his cheeks are still puffed out, as in f.238.

These points indicate that JC is still turning slightly to (his) right - his right shoulder going back round away from camera; his left shoulder coming forwards round towards camera, and is now about side-on to straight forwards position. He is falling to (his) right; and he has fallen slightly back towards Mrs. Connally from position in f.238.

In f.240:

JC has turned his head further to (his) right and is now facing square-on to camera - shadow line is down midline of face, face is/

is symmetrical. Head is tilted to (his) right.

Less of (his) right collar is visible than in f.239. Tie is barely discernible. Left collar not visible.

Angulation of line across shoulders is slightly less to line of edge of car from f.239. Tip of (his) left shoulder is still obscured by metal frame, and is a little higher than in f.239. Length of JC's left shoulder is just slightly more than in f.239 - due to his head turning to (his) right. Slightly less of JK's left arm is visible to right (i.p.) of JC's left arm. Angulation of line down his left arm is slightly greater than in f.239. The sunlit area down his left arm is just visible, as in f.239. These points indicate that JC's left shoulder and arm are falling back towards Mrs. Connally.

Length of JC's right shoulder is same as in f.239. Tip of (his) right shoulder is same distance from edge of car as in f.239, but is more to right (i.p.) of position in f.239. More roses are visible than in f.239. These points indicate that JC's right shoulder is moving down, back, and away from edge of car (away from camera, towards Mrs. Connally).

Slightly more of JC's hat and right hand are visible above edge of car than in f.239, indicating movement upwards and/or back away from edge of car.

Line down left side (i.p.) of JC's head is still to left (i.p.) of line down left side (i.p.) of JK's head. Same amount of JK's left blue collar is visible as in f.239. JC's head is still turning and falling to (his) right, but is also falling back slightly.

JC's hair is risen up, but a little less so than in f.239. His mouth is less widely open than previously and his cheeks do not/

not appear to be puffed out. The contour of his face indicates that it is not so elongated as previously.

These points indicate that JC has turned his head to (his) right from f.239, and is now facing the camera. His body has almost stopped rotating and is falling back towards Mrs. Connally. JC's head is still tilted to (his) right, but now is also slightly tilted back. His body is also tilting back; the greater amount of hat and (his) right hand visible also indicate this fall back away from edge of car.

f.241 is blurred, but some of the reference points are useable:-

JC is facing to (his) right of position in f.240, and is now facing to (his) right of camera. Sunlit side of nose is protruding into shadow side of face. His left ear is now visible. His head is tilted to (his) right and also back towards Mrs. Connally.

JC's tie, and right and left shirt collar are only vaguely visible due to the blurring.

The blurring makes measurement of the angulation across JC's shoulders difficult, but it appears roughly the same as in f.240. Tip of (his) left shoulder is still obscured by metal frame. Length of his left shoulder appears to have increased slightly from f.240. JK's left arm is now almost completely obscured by JC's left arm. Length of (his) right shoulder is difficult to judge, as is position of tip of (his) right shoulder. About same amount of roses are visible as in f.240. More of his right hand and hat are visible than in f.240. Line down left side (i.p.) of JC's head is just to left (i.p.) of line down left side (i.p.) of JK's head. Less of JK's left blue collar is visible than in f.240. It is difficult to judge if his/

his hair is still up, but his mouth still appears open.

These points indicate that JC is still turning his head to (his) right; his body and head are tilted to (his) right, but are falling back towards Mrs. Connally.

In f.242:

JC is facing well to (his) right of camera - sunlit nose protruding more into shadow side of face; his left ear is clearly visible; shadow line down face is to (his) left of midline.

Very little of (his) right collar is visible, less than in f.240. Tie is clearly discernible between right and left collars. Left collar is now just visible. Angulation of line across shoulders is similar to that in f.240. Tip of (his) left shoulder is still obscured by metal frame, and is higher than in f.240, relative to Mrs. Connally's right shoulder. Length of (his) left shoulder is slightly greater than in f.241. JK's left arm is now completely obscured by JC's left arm. Sunlit area down JC's left arm is visible.

Length of (his) right shoulder is same as in f.240; tip of (his) shoulder is slightly further from edge of car than in f.240. Same amount of roses are visible as in f.241. More of JC's hat and right hand are visible than in f.241. His right shirt cuff is now just visible again above edge of car. Line down left side (i.p.) of JC's head is still just to left (i.p.) of line down left side (i.p.) of JK's head. Slightly less of JK's left blue collar is visible than in f.241. JC's mouth is still open, and his hair still slightly risen from his head at (his) right side.

These points indicate that JC is still turning to (his) right./

His head and body are tilting to (his) right and back towards Mrs. Connally.

In f.243:

JC is turned slightly further to (his) right than in f.242 - shadow appearing under (his) left eye. His right eye is hardly discernible; shadow line down face is well to (his) left of midline. His head is tilted to (his) right and is tilted more back towards Mrs. Connally than in f.242.

Less of (his) right collar is visible than in f.242 - now almost obscured completely. Tie is visible, and more of (his) left collar is visible than in f.242. Angulation of line across shoulders is slightly less to edge of car than in f.242. Tip of (his) left shoulder is still obscured by metal frame, at same height as in f.242. Length of (his) left shoulder is same as in f.242. Sunlit area down (his) left arm is visible. Length of (his) right shoulder is slightly less than in f.242. Tip of (his) right shoulder is a little further from edge of car than in f.242. Same amount of roses visible as in f.242. Slightly more of hat, his right hand, and shirt cuff are visible than in f.242. Line down left side (i.p.) of JC's head is still just to left (i.p.) of line down left side (i.p.) of JK's head. JC's mouth is still open; hair still a little raised up.

These points indicate that JC's head and body are turned almost side-on to straight forwards position, tilted to (his) right and falling back towards Mrs. Connally.

In f.244:

JC is slightly nearer to side-on to straight forwards position - e.g. he is facing almost directly at right angles to direction of car's movement. He is facing slightly more to (his) right than in f.243 - (his) right eye is barely visible; shadow on (his) left/

left cheek is more pronounced than in f.243, and shadow line down face is more to (his) left of midline. His head is tilted less to (his) right than before but is still tilted back.

His right collar is almost completely obscured. Tie is — visible, as is (his) left collar. Angulation of line across shoulders is slightly less to line of edge of car than in f.243. Tip of (his) left shoulder is still obscured by metal frame. Length of (his) left shoulder is same as in f.243. Sunlit part of (his) left arm is clearly seen through the glass panel. Length of (his) right shoulder is slightly less than in f.243. Tip of (his) right shoulder is further from edge of car than in f.243. Same amount of roses are visible as in f.243. Less of his hat is visible than in f.243. About same amount of (his) right hand and shirt cuff are visible as in f.243. Line down left side (i.p.) of JC's head is still just to left (i.p.) of line down left side (i.p.) of JK's head. Less of JK's left blue collar is visible than in f.243. JC's hair is still slightly risen up, and his mouth is still open.

These points indicate that JC is still falling back towards Mrs. Connally.

To summarise, briefly, the analysis of the movements:-

On emerging from behind the traffic sign at f.222, JC is facing to (his) right and to (his) right of the camera. His body is also facing to (his) right and slightly to (his) right of camera - right shoulder back, left shoulder forwards. His hat is in his lap, brim horizontal, top upwards. At f.223 JC is in almost the same position as in f.222, having turned very slightly to (his) left - head is still facing to his right of camera but his body is facing fractionally to (his) left of camera; both head and body are still facing well to/
to/

to (his) right of straightforward. His right shoulder is still back, left shoulder forwards. His hat is still in his lap.

At f.224 there is a marked change in JC's position from f.223. Both his head and body have rotated notably to (his) — left; his right shoulder has moved forwards and downwards, his left shoulder has moved backwards and upwards. His hat has moved forward and/or to (his) left and/or downwards. From f.224 to f.228 JC continues this sharp leftward turn - left shoulder going back and up, right shoulder moving down and forwards. His hat and (his) right hand, which is holding his hat by the brim, move upwards, and backwards and/or to (his) right. At f.228 JC is facing to (his) left of straight forwards; (his) left shoulder is back and higher than (his) right shoulder, which is forwards. His body is approaching position of side-on to camera. His hat and right hand at the level of his chin. Thus in five frames JC has turned from an almost square-on position to camera (f.223) to a near side-on position (f.228); this is an extremely rapid movement, as can be seen by comparison with the speed of turn of Clint Hill's head and the speed of movement of JK's right hand.

At f.228 JC's left turn is at its furthest point, for in f.229 he has started his turn to his right. In the succeeding frames JC's left shoulder forwards, swinging round towards (his right) edge of car, and his right shoulder moves back, downwards, and away from camera. His body thus tilts to (his) right. His head does not turn at the same speed as his body - is slower than body turning - thus (his) left shoulder approaches his chin. The hat rotates, front edge moving across to (his) right; and it also rotates into a position where the brim is vertically aligned (f.230-1). Both hat and his right hand move down, back and/or to (his) right. The rotation of his body to (his) right continues/

continues and by f.233-4 JC's body is square-on to camera, with his head facing straight forward. Thus JC has turned his body back to the square-on position in five to six frames; again, a very rapid movement. It can be seen that JC's left shoulder is moving round to (his) right, (up slightly) and towards edge of car (and thus approaching his chin) by the fact that his left coat lapel and his chin obscure his left shirt collar from view through f.228 - f.240. This absence from view of his left collar is partially notable at f.233-4 when JC's body is square-on to camera and one would expect, normally, to see his left collar as in f.222-3). Another indication of the approximation of his left shoulder to his chin is the fact that through the sequence (f.228-f.240) the length of his left shoulder is less than that of his right shoulder whilst, at the same time, his left shoulder is moving forwards and round to (his) right.

The rotation to (his) right continues; (his) right shoulder moving down, back and round away from camera, (his) left shoulder moving forwards and round towards camera, with his body tilting to (his) right. At f.234-5 JC's hair begins to rise up at (his) right rear of his head, and his mouth begins to open. His hat continues down, back and/or to (his) right. JC falls to (his) right from f.234 to f.239-f.240, at which point JC has turned so that he is now approximately side-on to the car, with his head square-on to camera. JC's body was approximately straight forwards at f.230-1, and he is approximately side-on at f.239-40; thus the turn of his body through 90° takes about nine frames. This is a quite rapid movement (the speed of the turn, as compared with turn through f.228 to f.233-4, indicates that the turn to his right slows slightly after passing through square-on position to camera).

At f.239-f.240 JC starts to fall backwards Mrs. Connally.

This/

This is illustrated by the increasing amount of JC's right hand and hat visible, and the rapid disappearance of JK's left arm behind JC's left arm through f.238-f.241. After f.238 the line down JC's right arm increases in angulation to line of edge of car - it approaches 90° to it. This is also illustrative of the fall back towards Mrs. Connally at f.239-f.240 - (his) right shoulder goes back away from edge of car, his body tilting back; this line down (his) right arm naturally increases (e.g. goes off vertical (i.p.) - is vertical (i.p.) in f.238) due to shoulder moving away from camera more than (his) right elbow (which was probably resting on his torso and possibly, also, (his) right side (arm) was against the back of the jump-seat JC was sitting in. Through f.240 to f.244 JC falls back towards Mrs. Connally, with the turn to (his) right slowing markedly.

What conclusions can be drawn from this interpretation of the frames? JC was hit in the chest, right wrist, and left thigh. The bullet through his chest entered just to the right of his right shoulder blade just below the axilla, coursed forwards and left, along his fifth rib, at a downwards angle of 27°. The bullet which injured his right wrist was not necessarily the same bullet which inflicted the chest wounds; but, from the medical evidence, the wrist wound was caused by a tumbling bullet, not a pristine bullet - thus it struck something, or someone, first; this would almost certainly have to be JC's chest or JFK's head (the latter deemed unlikely from other evidence). The bullet which injured the wrist entered the back of the wrist, and made its exit through the front. The thigh wound was inflicted by a bullet or bullet fragment having a relatively low velocity.

It is necessary to bear in mind the wounds, and the direction of/

of the bullet through the chest, in trying to assess the point at which JC was hit. The bullet through his chest (and probably his wrist) travelled through him going forwards, downwards, and to the left. Between f.222 and f.223 JC turns very slightly to his left. Between f.223 and f.224 there is a marked change; a sharp increase in JC's turn to his left - his right shoulder moves forwards and down (and his left shoulder moves up and back). This movement continues, very rapidly, through till f.228, when JC is clearly facing to his left of straight forward and his body is near side-on to camera (having been square-on to camera at f.222-3). This turn, through a near right angle takes place in five frames - 0.275 seconds. Compare the speed of this movement to the speed of turn of Clint Hill's head through an angle well short of a right angle - 12 frames (0.66 seconds) - in his response to hearing the shot(s). The movement JC undergoes is clearly far more rapid than the turn of Hill's head. Similarly it is more rapid than the movement of JFK's right arm, through approximately a right angle, in reaching for JFK's left elbow - 11 frames (0.61 seconds). JC's rapid movement through f.223 to f.228 is in the same order of speed as the speed of movement of JFK's head after being hit at f.313-4 - in 5 frames (0.275 seconds) JFK's head moves back approximately six inches.

Between f.223 and f.224 JC's hat, which was sitting apparently still in his lap, top upwards and brim horizontally aligned, has moved rapidly downwards and/or forwards and/or to JC's left. As seen in later frames, JC was holding the hat by the brim with his right hand; and with the hat in the position it was in at f.223 his right hand would be positioned with the palm downwards, back of hand upwards. The movement of JC's right shoulder and hat (and presumably his right hand) is thus rapidly downwards, forwards and to his left. This indicates that impact of a bullet/

bullet has occurred between f.223 and f.224, causing the sharp movements to occur, and the bullet has passed through his chest and, almost certainly, his right wrist.

At f.225 the hat reappears and his right hand is just visible. Through to f.228 the hand and hat move upwards, and probably backwards and/or to his right. This movement is accounted for by the fact that JC's right shoulder is moving rapidly downwards, forwards, and to JC's left and this forces his right elbow down onto his right thigh (at f.224); as the right shoulder continues its movement the right elbow courses forwards along his right thigh - this results in his right hand, holding hat, moving upwards and backwards relative to his right elbow, moving closer to his right shoulder; so that at f.228 the right shoulder is well forwards, right elbow on his right thigh, his right forearm positioned almost vertically upwards with his right hand near to the level of his chin.

JC testified before the "Warren Commission" that he heard a gunshot, turned and looked over his right shoulder, but did not see JFK; he was turning to his left in order to look over his left shoulder, and reached the position of facing a little to left of centre when he felt that someone had hit him in the back. From f.222, one would expect, if JC was turning to his left (as he did, fractionally between f.222 and f.223) to look over his left shoulder, that his left shoulder would go down and back round to his left and that his right shoulder would move forwards and round, and upwards slightly. It is clear that this did not happen - JC's left shoulder moves up, not down; his right shoulder moves down, not upwards.

After f.228 JC turns back to his right, his body moving round/

round in advance of the turn of his head. The right shoulder moves rapidly down, back and round, the left shoulder rapidly forwards, round, and upwards slightly. This movement is continuous through f.228 to f.239 and is accompanied by the (inevitable) tilt (and fall) to his right.

From f.228 onwards JC's hat moves down, back and/or to JC's right. There is also a rotation of the hat - at f.228 the top of the hat is visible as the highest part of the hat (the hat is not sitting with brim horizontal as in f.222-3, and is slightly inclined), but in f.229 the top has moved down and in f.230 it is further down, very little now visible. In f.230 the brim is clearly visible, for the first time, above the top of the hat - the brim is aligned almost vertically (e.g. nearly at right angles to position in f.222-3) and the plane of the brim of the hat is directed to JC's left (e.g. front edge of brim is to JC's left of the back edge of brim - the edge JC is holding in his right hand). Through subsequent frames, to f.234, the hat rotates so that the front edge of the brim moves to JC's right of the back edge of brim. The brim remains aligned almost vertically throughout. After f.234 there is little of the hat visible and all that can be seen is that it moves down, back and/or to his right till f.238.

At f.239 JC starts to fall backwards, his right turn slowing down. There is no movement which would indicate a hit to JC in any of the frames through the sequence when JC turns to his right after f.228 (up to and including f.244). Some researchers believe that the angulation of the line along JC's right shoulder to the line of the edge of the car alters sharply between f.237 and f.238, thereby indicating the hit to JC's right shoulder between those two frames. I do not see as sharp an alteration of/

of the angulation as do those researchers; the shoulder (black coat) is merged to some extent with the shadow under JK's right arm through f.235 to f.237, then at f.238 JK's right arm is clear of the shoulder, the dark images no longer merging - this may be a confusing factor. But more important than this, simply measuring the angulation of the line along his shoulder to the line of the edge of the car does not take into account any movement in three dimensions; and it is quite clear from the above analysis that JC's right shoulder is moving down, back and round away from the edge of the car in the sequence f.235 to f.240 - the simple measurement of an angle between lines in two dimensions is thus invalidated in this case.

The turn to his right after f.228 is clearly JC's recoil reaction to being hit. This also ties in accurately with JC's testimony - he described feeling "like someone had hit me in the back" when he was "looking a little bit left of centre", and then he "doubled up, and then turned to my right again". At f.228 JC is facing slightly to left of centre (e.g. slightly to his left of straightforward) and the recoil turn to his right starts thereafter. Thus the reaction time (time from impact to start of the recoil reaction) was five frames - 0.275 seconds.

To conclude, analysis of the Zapruder frames 222 to 244 indicates that Governor Connally was struck by a bullet which passed through his chest, and most probably his wrist, at a time between f.223 and f.224 (the first effects of the impact being discernible at f.224). The Governor started to react (0.22 seconds to 0.275 seconds later) after f.228. As was seen previously, President Kennedy was struck by a bullet, entering his back or neck, a number of frames prior to f.224-5, at which frames he is clearly reacting to a shot and had started his reaction some time before f.224.

Thus a further conclusion is that President Kennedy and Governor Connally were shot by separate bullets.

(A comparison of f.225 and f.223 which appeared on S.P8 in 'Life International' issue November 28, 1966 illustrates the effect of the bullet hitting Governor Connally. The frames are 0.11 seconds apart - thus there would be very little relative movement between JC and JK if they both remained stationary (this can be seen from the negligible relative movement between any of the images (objects or occupants - apart from JC and JK) in the frames).

In f.223 JC is facing to his right of the camera, body facing fractionally to his left of square-on to camera - his right shoulder is back relative to his left shoulder which is all but obscured by the metal frame. His head is just slightly tilted back. The lines down the inner edges of his coat lapels are parallel to each other, are just slightly off parallel to edge of road sign. The top of his hat is clearly visible, in front of him, the shadow line down the hat being clearly visible. The line across his shoulders is almost parallel to line across back seat - the slight angulation being due to his right shoulder being back relative to his left shoulder. Little of JK's left arm is visible to right (i.p.) of JC's left arm.

In f.225 JC is facing fractionally to his left of square-on to camera. His body is turned well to his left of square-on to camera, and is possibly facing a little to his left of straight forward. His right shoulder has clearly moved down and forward from f.223 - increased distance of tip of his shoulder from line across back seat. His left shoulder has moved up and back - much more of JK's left arm is visible, and the tip of his left shoulder is now at the level of Mrs. Connally's right shoulder, it was below this level in f.223. His head is tilted to his right - and there is less of the line along top of JK's right shoulder than in f.223, due to this head tilting. The sunlit areas of JC's/

JC's coat at his right shoulder are quite clear in f.225 - are only vaguely visible in f.223; this also shows JC's right shoulder has moved forward markedly. The line down the inner edge of his right lapel has moved across and is obscuring some of his tie; the lines down the inner edges of the lapels are far from parallel to each other, but with little change in the angulation of the line down his left lapel. His hat is blurred, greyish rather than white, (and a little of his right hand is visible) and a shadow line is not obvious. The angulation of the line across his shoulders is now angled a little off parallel, in opposite direction to that in f.223, to line across back seat of car - angulation is accounted for by left shoulder being back and up relative to right shoulder.

The differences between the two frames are quite marked yet the time difference is only 0.11 seconds. Thus JC's movements are extremely rapid, and demonstrate clearly the effect of the bullet impact (after 0.11 seconds maximum).

In f.225 JFK has clearly started his reaction to being hit, as stated previously, to a hit well before f.224-5. JC does not start to react till 0.22 to 0.275 seconds after the bullet impact and his reaction is not really comparable to that of JFK's in f.225 till at least f.234-5 - 0.61 to 0.665 seconds after impact. JFK may have had a faster reaction time than JC but even so his reaction at f.224-5 is quite unmistakable and could not have been due to a hit between f.223 and f.224 - JFK could not have reacted to this extent so quickly (for physiological reasons of speed of reactions). And other evidence indicates that JFK was in fact hit just prior to f.200. Thus JFK and JC were hit by separate bullets, approximately 1.5 seconds apart.)