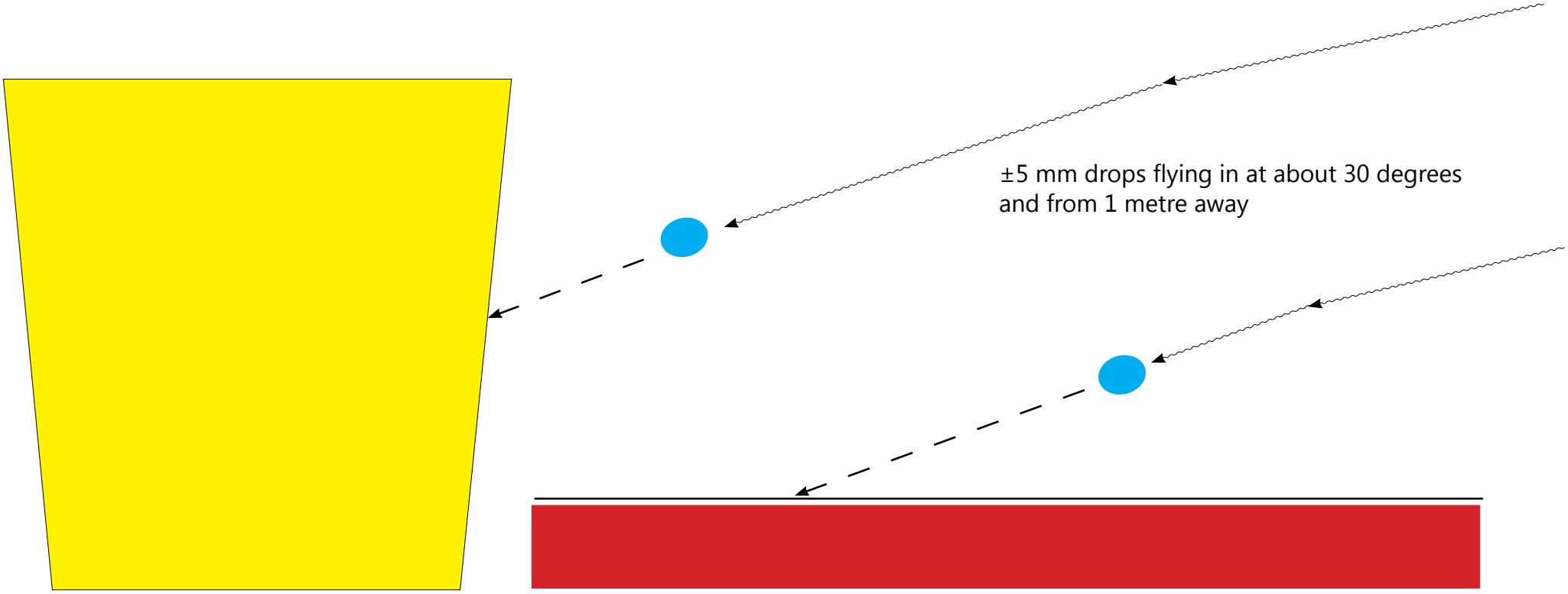
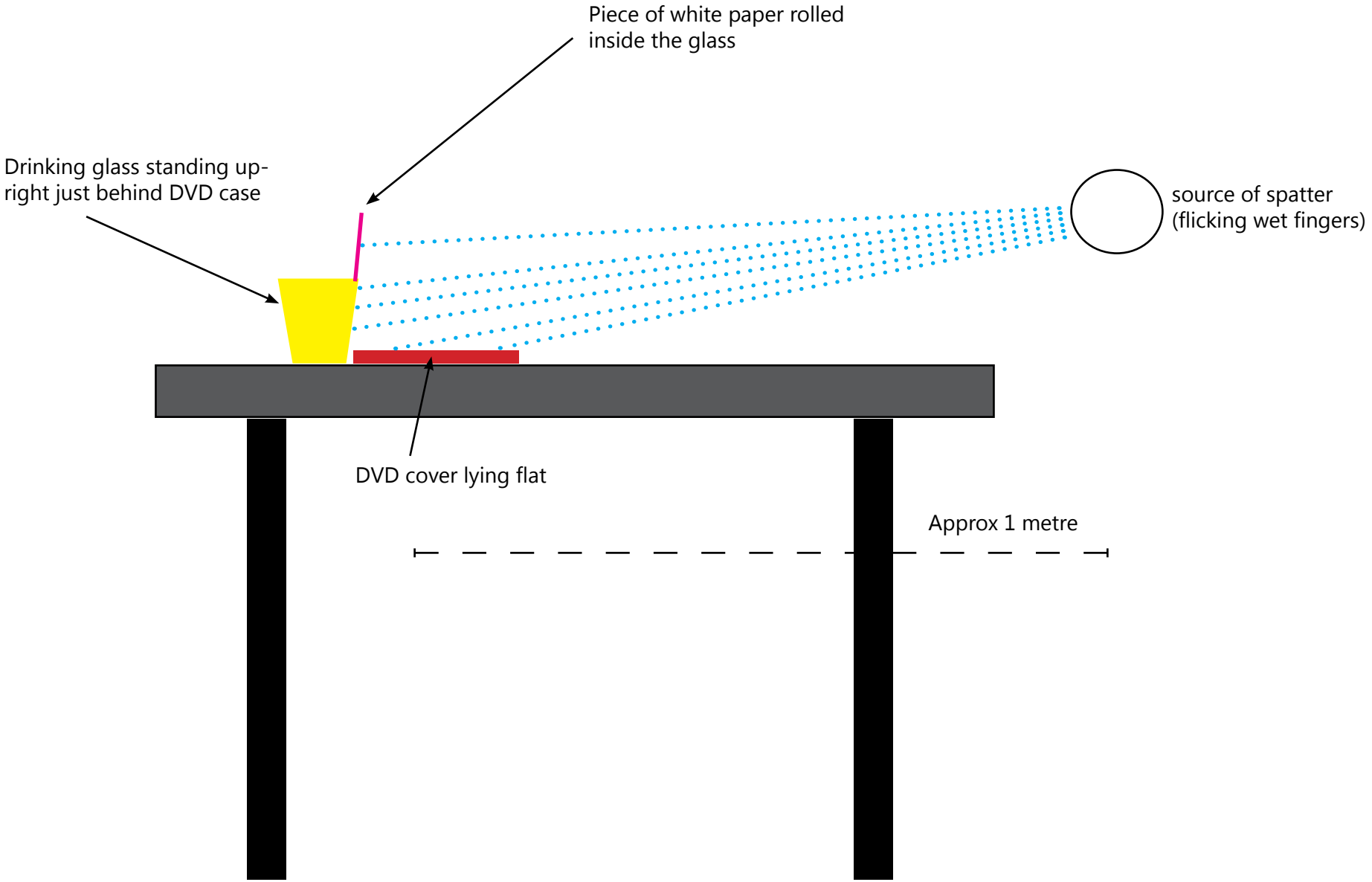
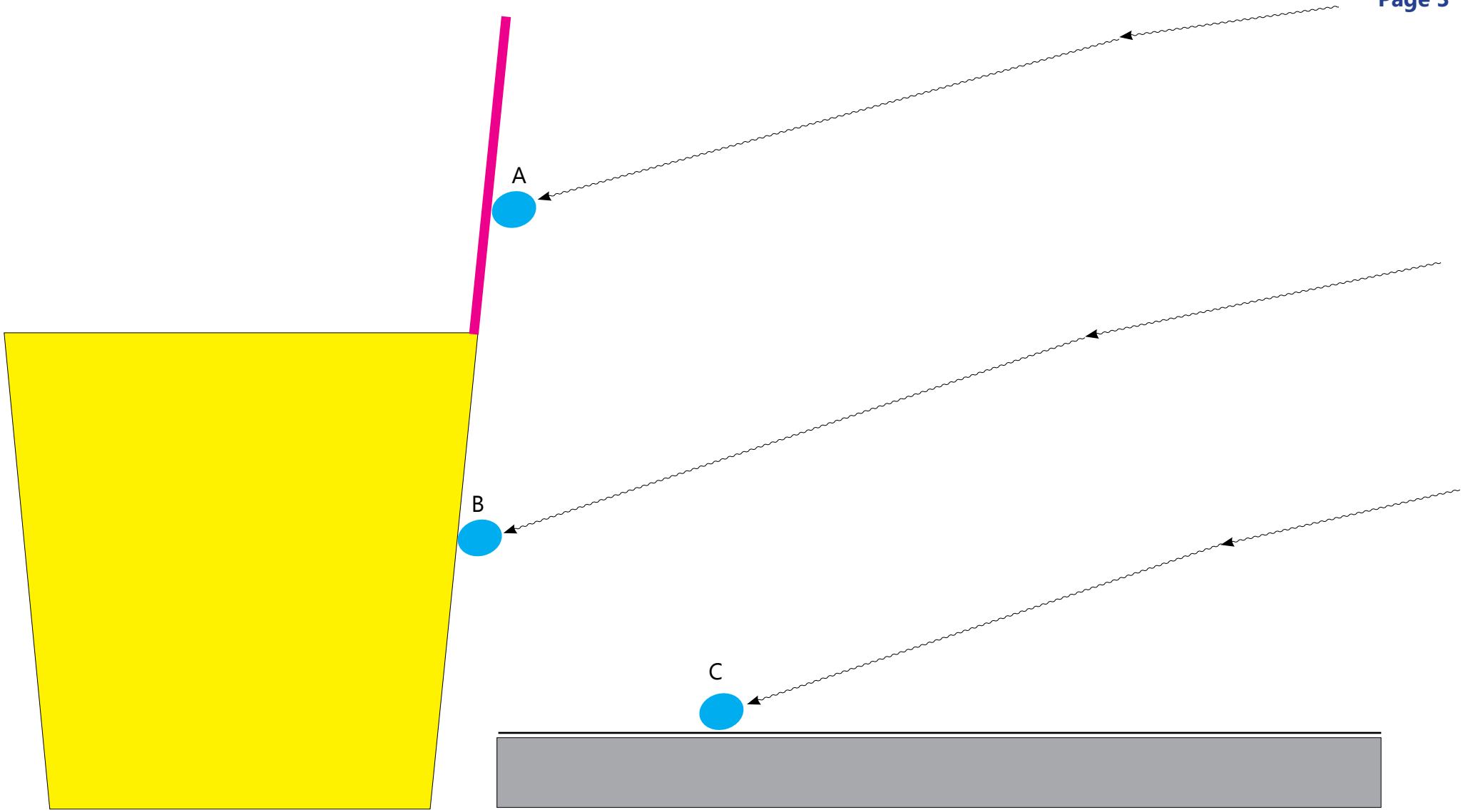
THE BEHAVIOUR OF SPATTER

How will these drops react during and after impact?



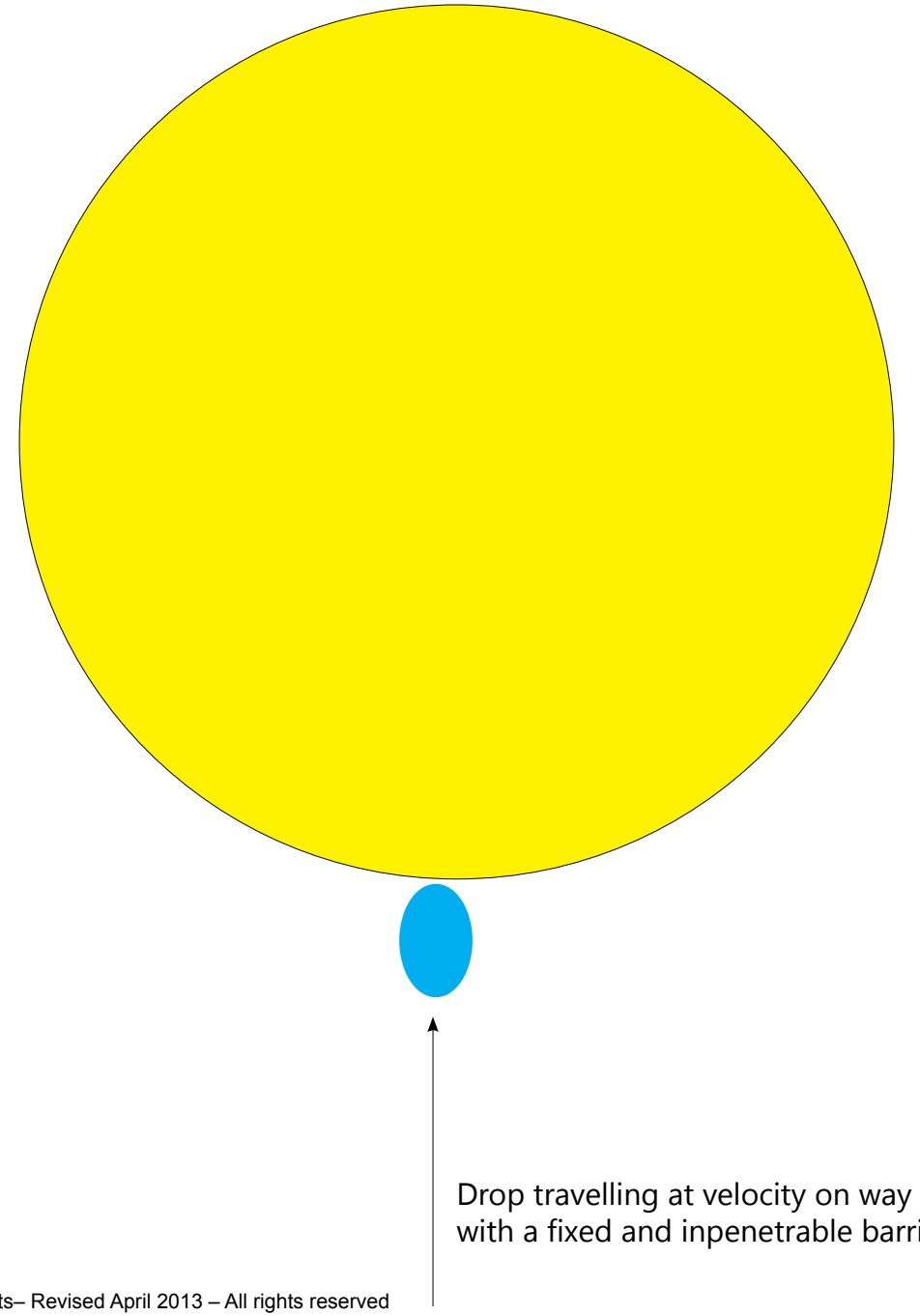
An experiment was set up to show how the same spatter would react on a vertical glass surface and a flat plastic object. The source of the spatter was slightly coloured water and was projected from about a metre away with the flicking of wet fingers. Thus the drops travelled for about a metre, coming in at a slight downward angle of about 20 degrees before hitting the respective objects. A piece of white paper was rolled into the drinking glass in order to see how the spatter would react to a different vertical substrate.



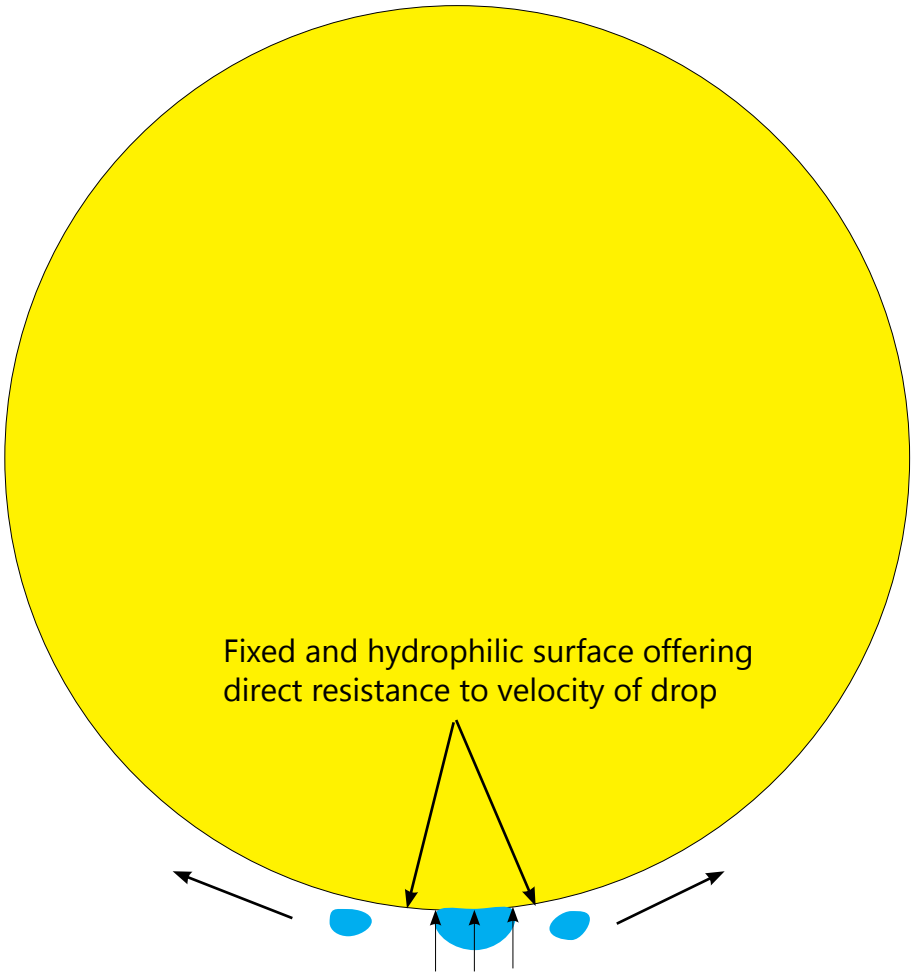


A - drop about to make contact with flexible and absorbable paper
B - drop about to make contact with a hydrophilic, hard and unmoveable glass surface with an vertical and inclided angle, also with a curved interface
C - drop about to make a soft landing on a plastic sleeve with a thin layer of air under it

What happens to drop during and after impact?

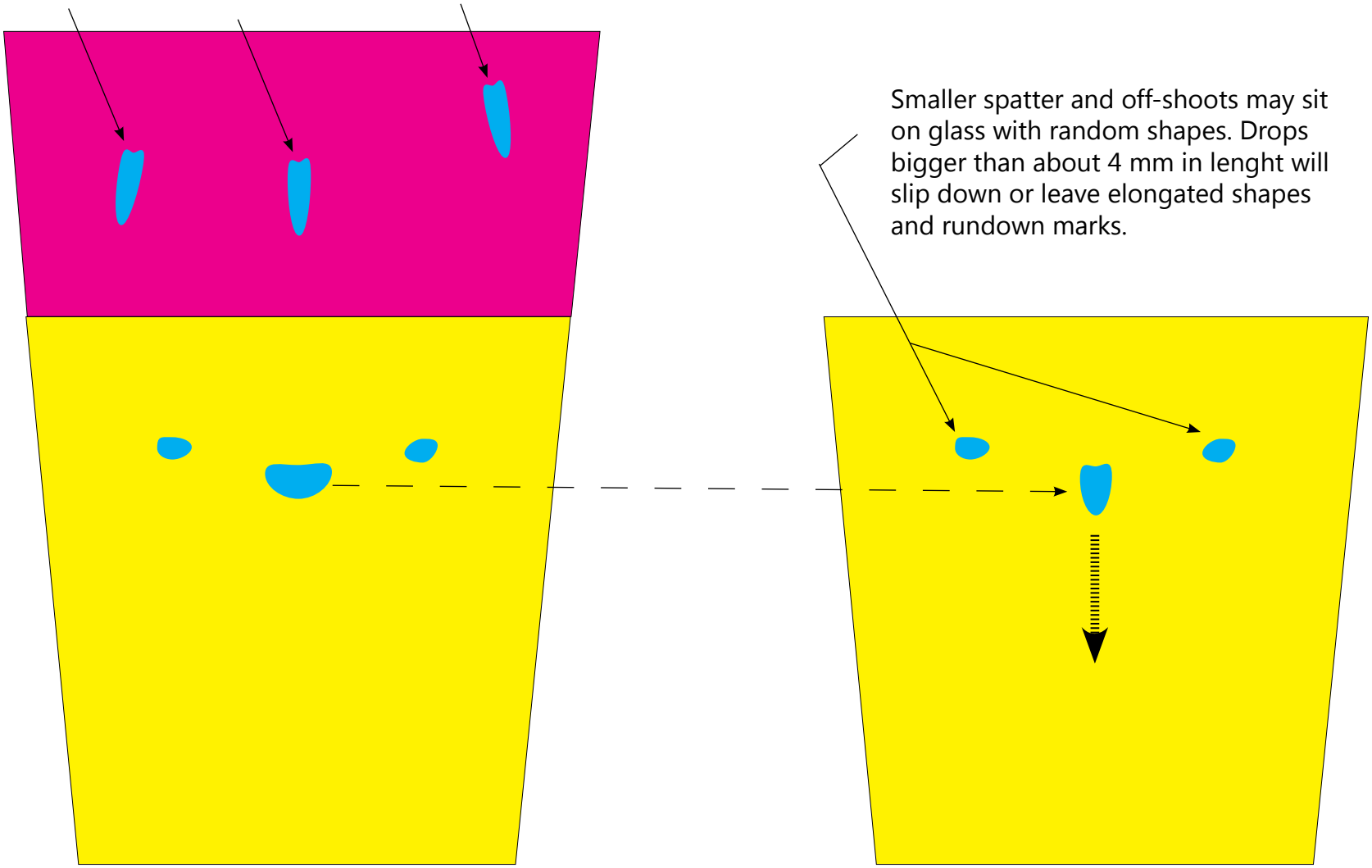


Drop travelling at velocity on way to a collision with a fixed and inpenetrable barrier



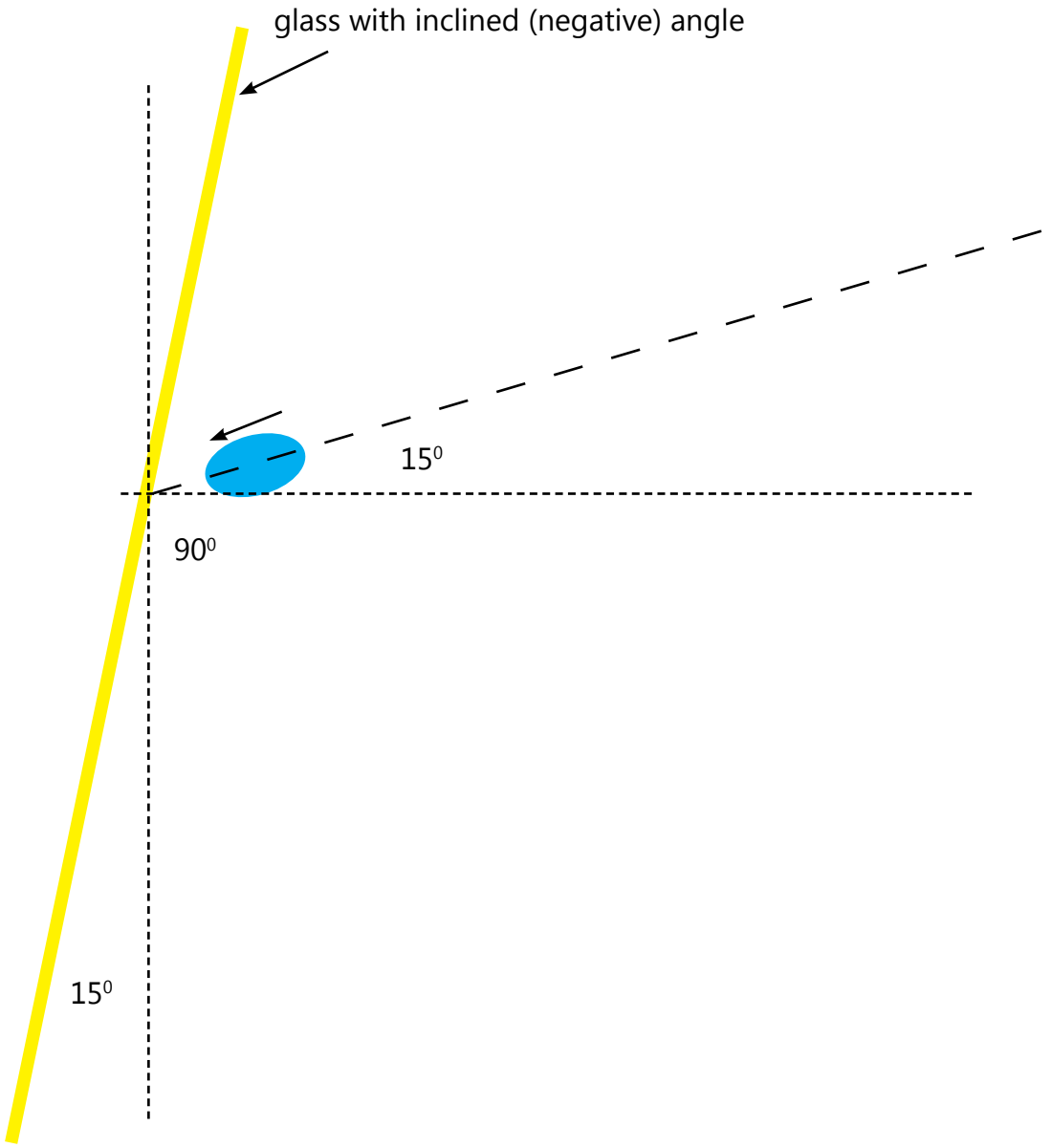
Due to velocity and a fixed barrier, the drop breaks up in smaller drops, some landing further on the glass, some simply falling down to the ground.

Drop on the protruding paper is relatively large and shows no sign of off-shoots. This is because the paper offered some absorbtion to the velocity. Thus the drops have less reason to break up.There is also no major running down of drops because the paper partly absorbs the fluid. This shows how the glass plays a role in how the drop reacts on and after impact.

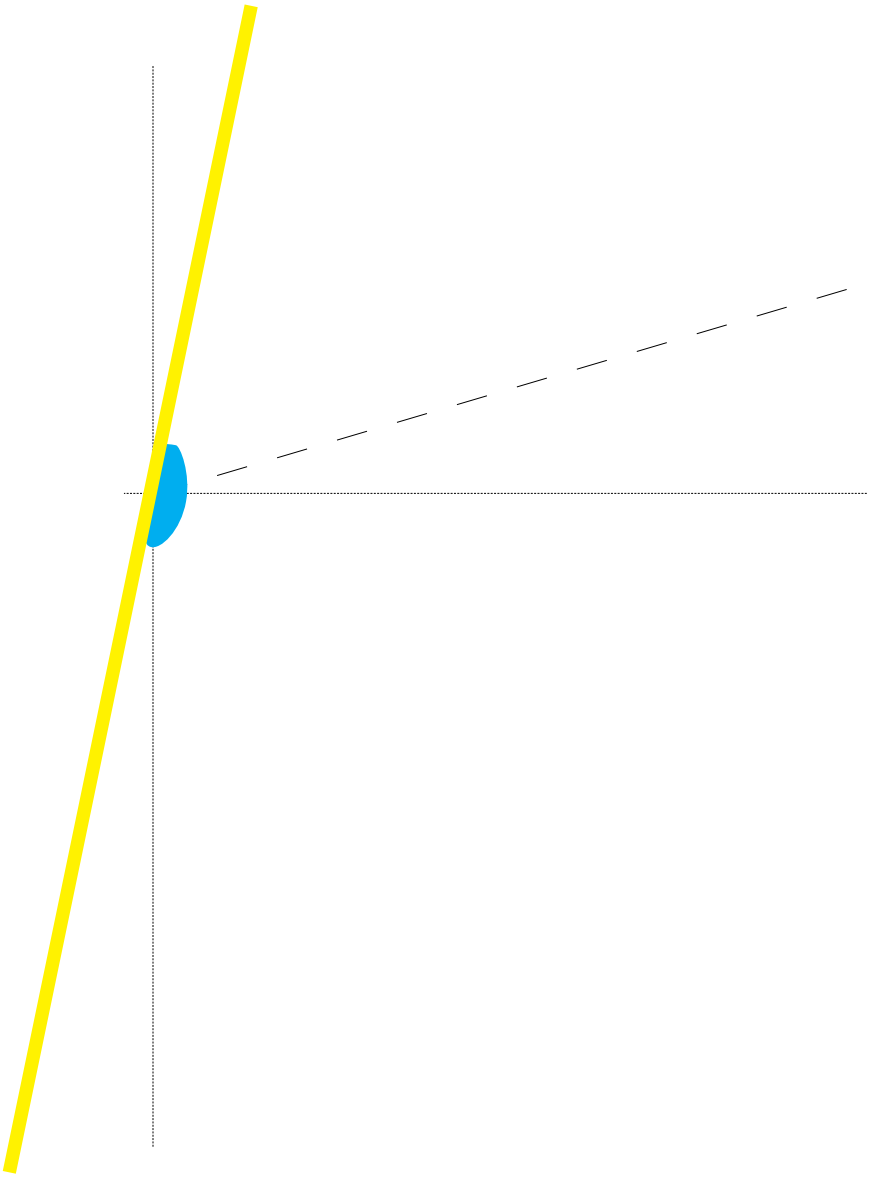


Smaller spatter and off-shoots may sit on glass with random shapes. Drops bigger than about 4 mm in lenght will slip down or leave elongated shapes and rundown marks.

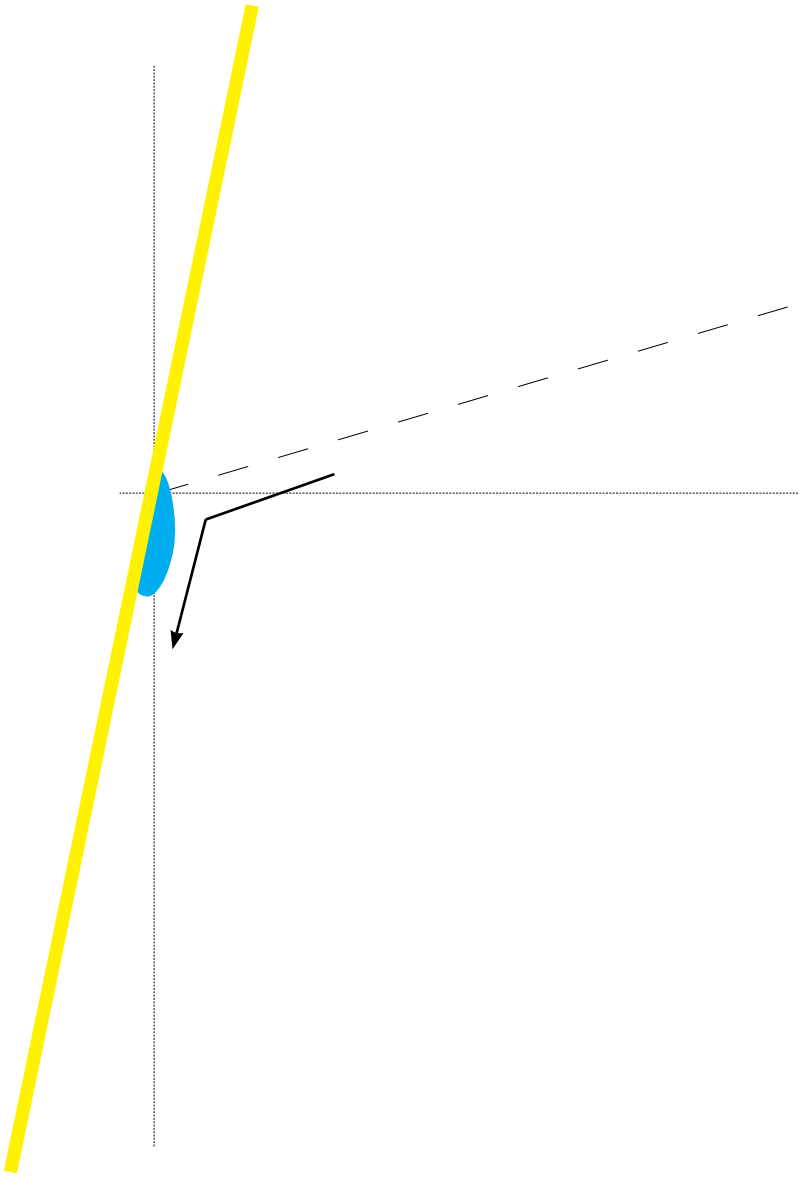
What will happen with this drop, coming in at a 15 degree downward angle, hitting an already inclined angle of 15 degrees (effective entry angle of 120 degrees)?



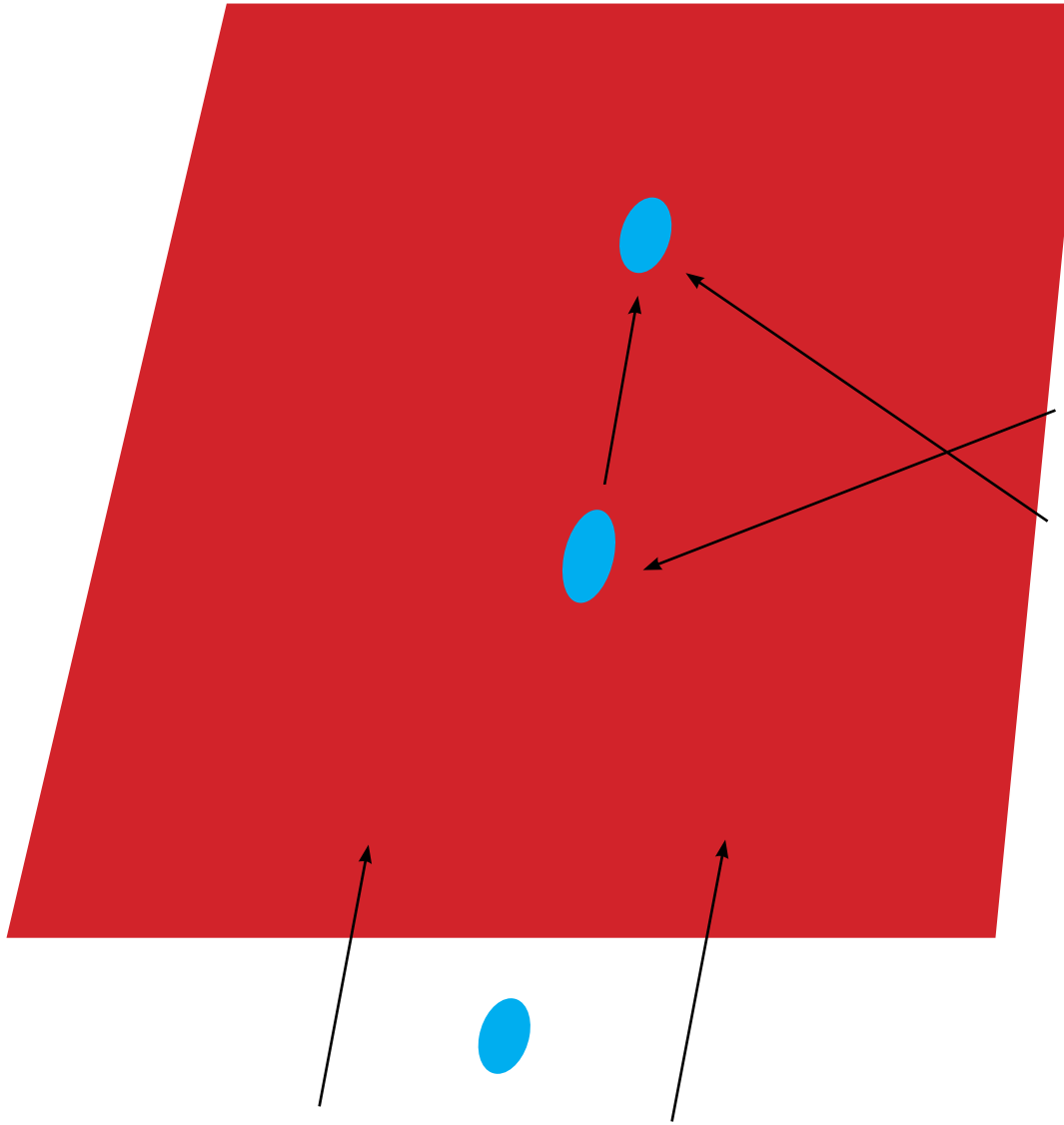
Will the drop sit neatly like this?



Or would the entry and contact angle, together with the velocity and momentum force the drop into a more downward shape?



WHAT HAPPENS ON A HORIZONTAL LAYING DVD CASE?



The drop hitting the surface is initially a bit stretched due to velocity and entry angle, but due to surface tension and the nature of the sleeve, the drop pulls back together to leave a neat elliptic shape. Due to the weight and impact accommodation of the surface and entry angle, drops generally do not break up.

Drop flying in at about 20-30 degrees downwards, spattered from about a metre away.

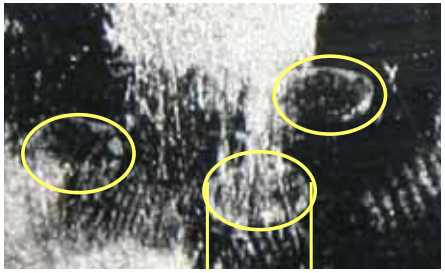
before impact

after impact

Top view of glass

Will these three drops have more or less the same shape as each other after hitting the curved surface?

Or will the velocity and entry angles force the drops along the opposing sides, resulting in different shapes?

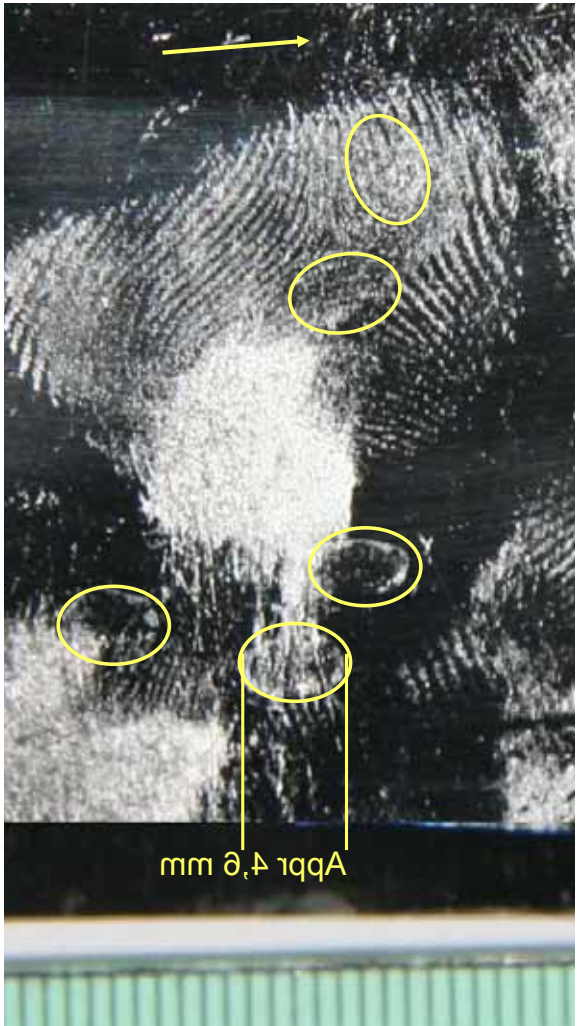


before impact

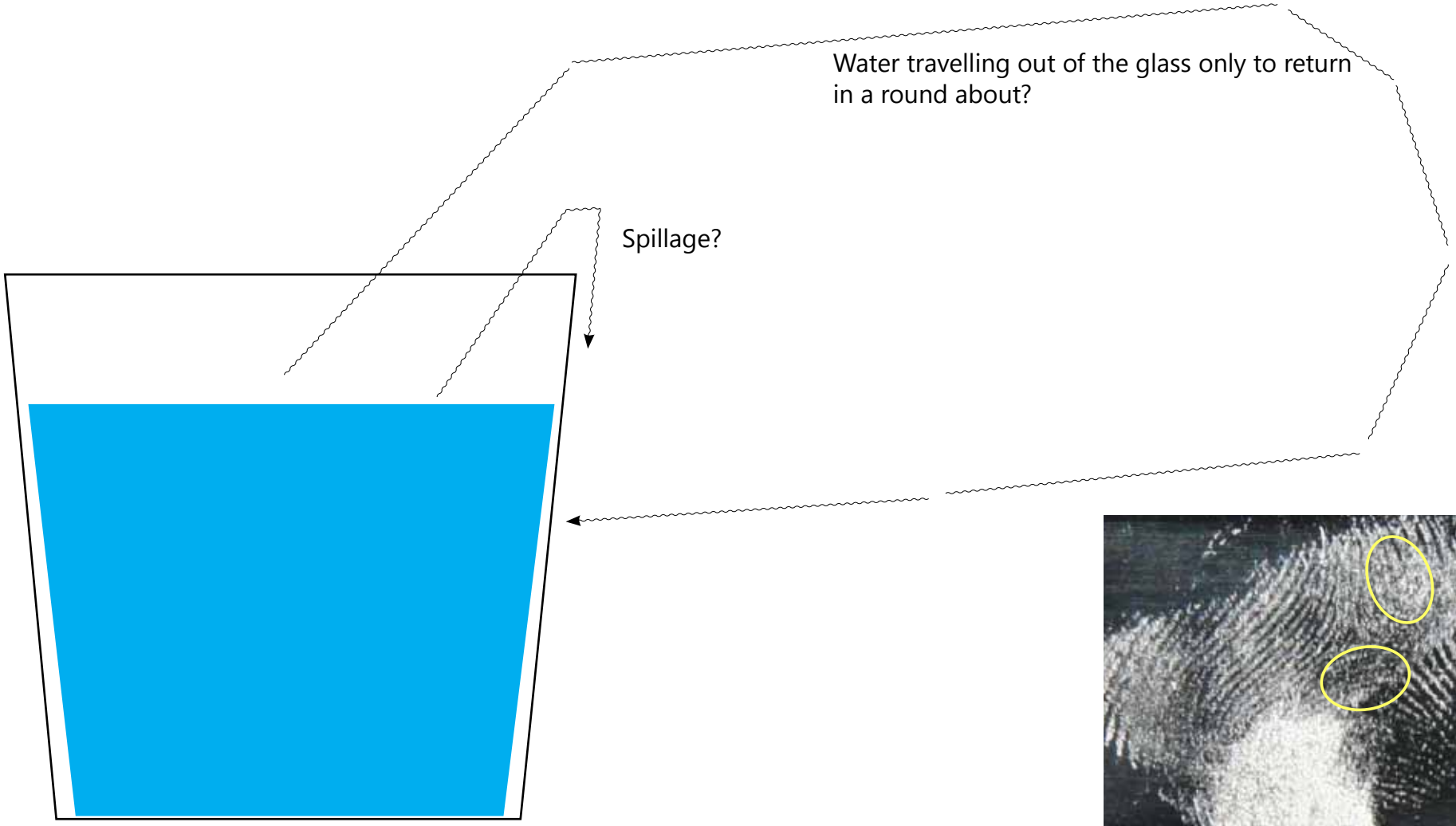
after impact

Front view of glass

Taking the curved and inclined nature of the glass into account, can we really believe that these drops would all have the same size and shape, and that ALL of them seems to be unaffected by impact and gravity. Remember, we are talking about 5 drops larger than 4 mm. And they all stayed like that? Possible? A scale of likelihood and probability will never support this. They are all big drops and had to have some velocity when they impacted. The first possibility is that by that by being the sizes they are they would have broken into smaller drops at impact (as we will see in our practical test). The second is that the bigger drops would have run down or if they stayed stationary, had unequal ring deposits (locted more towards the bottom only) and displayed some sort of downward tendency in their shape. These are not present in any of the drops. (Maybe the top one can be disputed, although we are not sure on what basis Mr Zeelenberg claimed for sure that that is a drop mark). Even if you focus only on the bottom three drops, and you look at their sizes and shapes it is still highly unlikely that they arrived and dried on a vertical surface.



How would the drops have gotten onto the drinking glass?

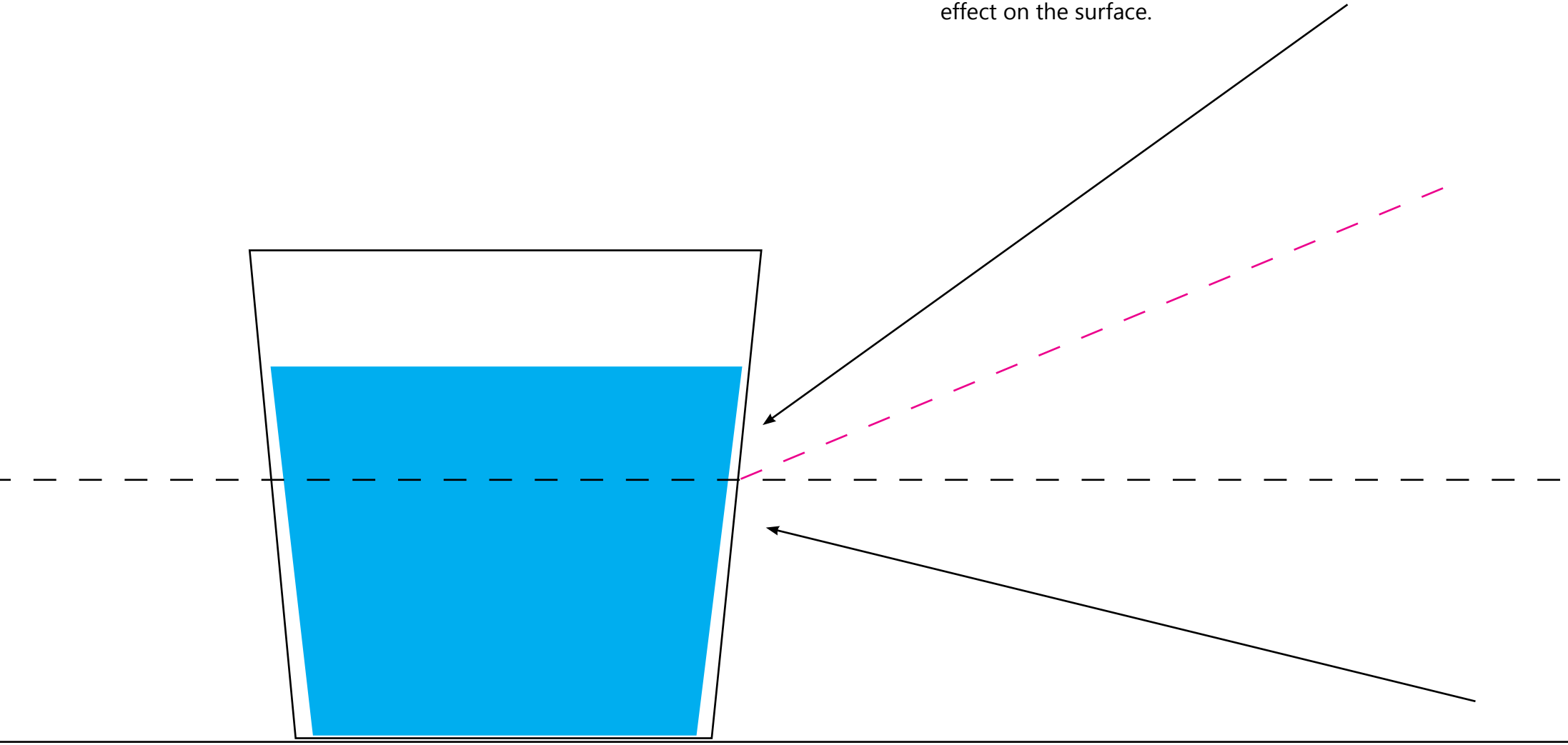


It is safe to say that the drops in question could not have been from the water of the same glass. Spillage would not produce drops like these. It will leave running marks from the edge downwards. It is also impossible for spatter from the same glass to return in a U turn like fashion to the same glass.

Spatter from a different source?

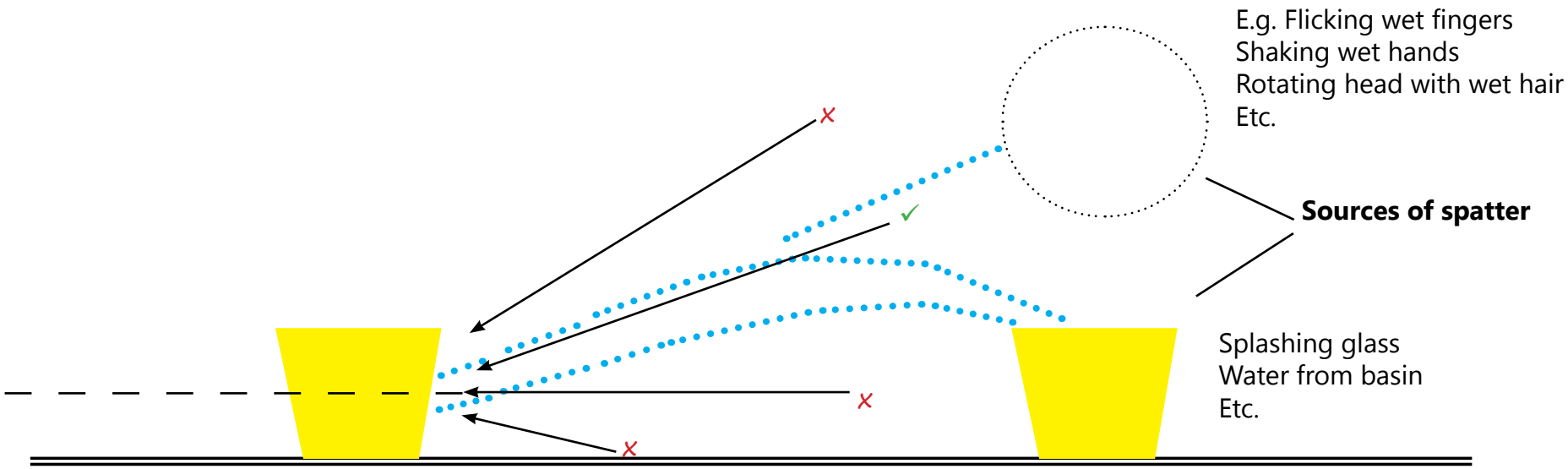
What would be the most likely entry and impact angle?

Imagine what would happen with a drop if it came in from an angle of higher than 30 degrees? Most certainly it will have a downward effect on the surface.



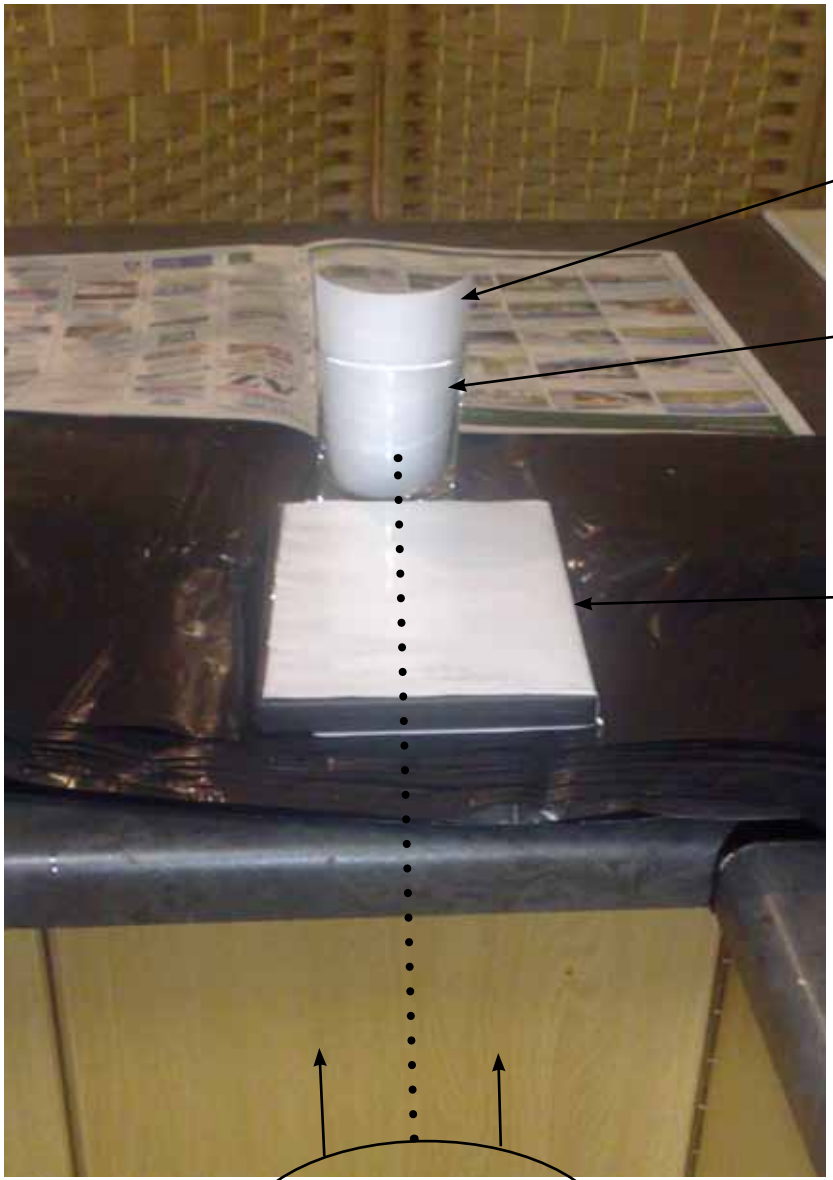
Under what circumstances will drops come in from an angle of lower than 90 degrees?

Most likely source of spatter



If we forget everything else for the moment: If the drops would want to stand any chance of getting onto the surface and to look anything like the drops on Folien 1, it would need to come in at an angle of about 20-30 degrees. Anything higher would most certainly leave elongated downward shapes due to the entry angle and velocity. Practically anything below the parallel mid-line of the glass becomes unlikely.

PRACTICAL EXPERIMENT



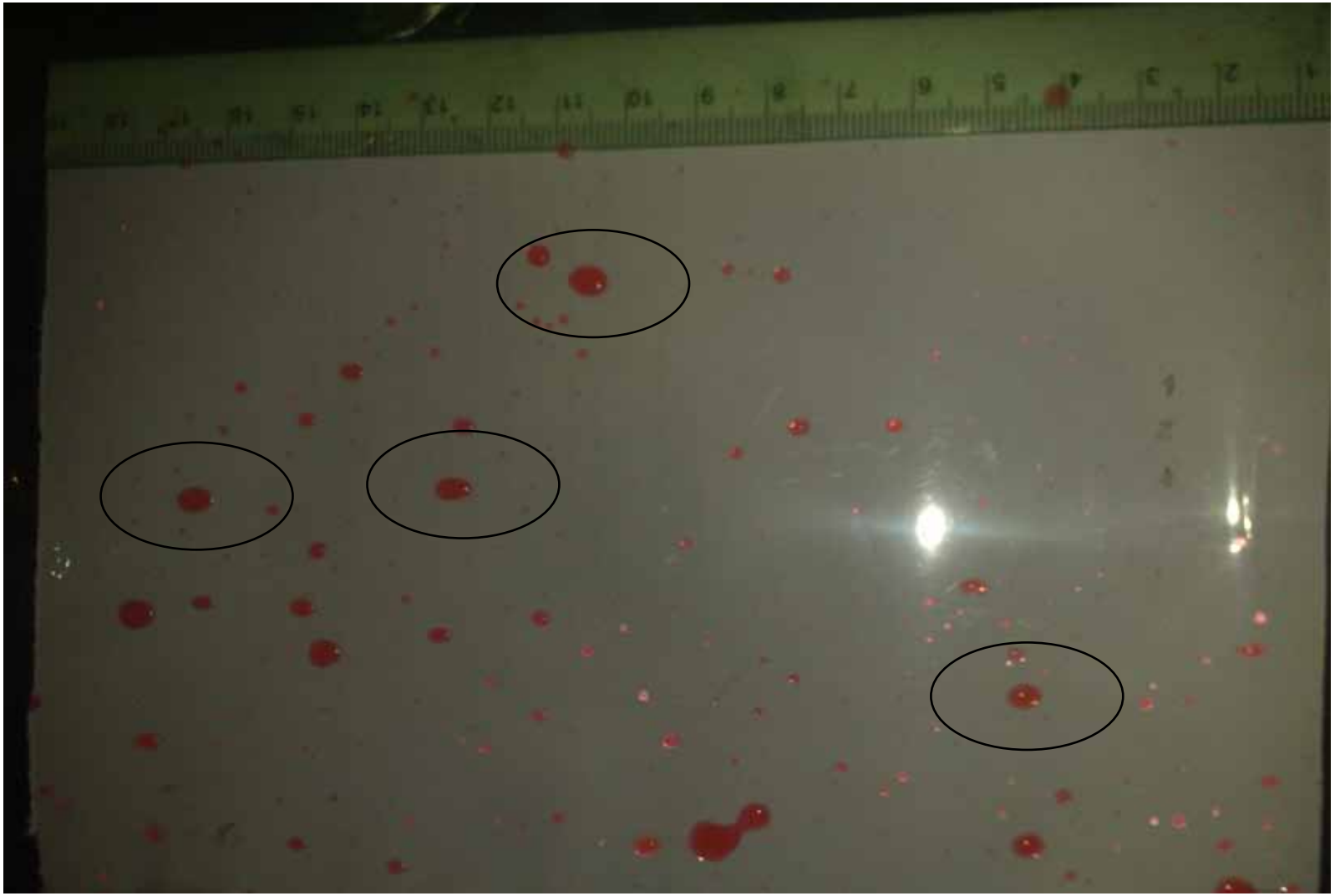
Immediately after splashing

Drops on paper show some volume. It seems like drops breaks on impact with glass, leaving smaller dops on the glass.

Smaller drops that do not run down are in the region of 3 mm by 2 mm, slightly oval down-wards. Shapes random. Not so visible on photo, but rundown marks also present.

Drops bigger and intact, reflecting entry angle, smooth shapes

This experiment clearly shows how drops break on impact with a hard inpenetrable surface. Also that drops bigger than 3 mm will run downward and that shapes will be random. Shows that drop shapes on DVD sleeves are generally smooth and bigger.



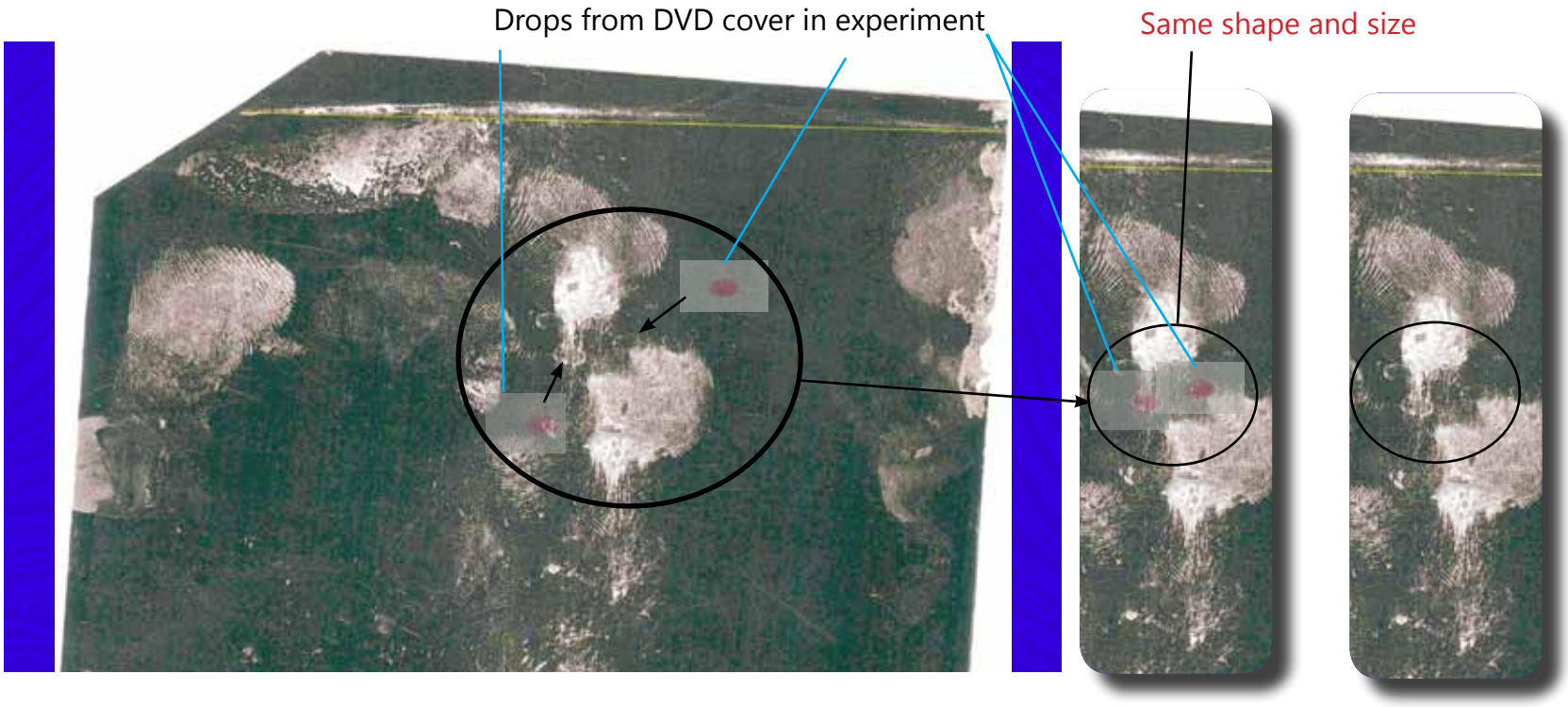
Spatter on DVD case

Note that most have extremely smooth shapes, basically elliptic

Due the uneven nature of the sleeve, drops may even not be completly in same direction (as you will also find on Folien 1)

On scale drops from DVD after 1 m / 20-30 degree water splash with fingers

Drop size and shape fits F1 drops' size and shape exactly



What is very important to note: The drops on the glass were completely dry in about 15 minutes after splash. (On a cold winter night)

Conclusion

Unlike Mr Zeelenberg suggested, it is certainly most possible to have elliptic shape drops on flat horizontal surfaces. In actual fact, it is much more likely to have them on a flat horizontal surface than on an inclined, curved and vertical surface. Practical tests will confirm this and we invite anybody to repeat our tests. Please do test it.

We will not be so arrogant as to suggest how and why the drops arrived and dried wherever they did. What we do know is that a DVD cover travels around and in the process it may get subjected to an environment of spatter – just as a glass. Or any moveable object for that matter. Somebody sneezing. Cleaning detergents. From a wet cloth. Somebody shaking wet hands after they washed it. A dog shaking its wet hair. Or a human being. A cover lying next to a kitchen basin. Laying next to a glass of water when you popped ice into it – causing spatter. And so on. And then there is also the posibility that they simply dropped from an object that moved over the cover. Drops from a condensed glass. Or from a wet cloth. Anything could have happened. We will not know if we were not there.

But what we can put forward as a possibility is that these dry drops could have been deposited on the cover any time before Inge's death. She only had it from 15:00 onwards. Why could it not have been deposited the morning at the DVD store? Even the previous day.

Saying that, wherever and however, theoretical and practical results will support the deduction that the drops were deposited (most possibly by spatter) on a flat horizontal object and not on an inclined, vertical and round object.