

The Solvent Star

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Fife, G.R., 'The Solvent Star: assessing and documenting solvent selection.' The Picture Restorer (number 56, spring 2020), <https://www.bapcr.org.uk/the-picture-restorer/>

Fife G.R., 'Solvents and Paint Films: Practical Solutions, SRAL, 20-22 October 2019

References from The Picture Restorer Publication for related reading:

Baij, L., Astefanei, A., Hermans, J. et al. 2019. 'Solvent-mediated extraction of fatty acids in bilayer oil paint models: a comparative analysis of solvent application methods'. Heritage Science 7 (31).

Klamt, A. 2011. 'The COSMO and COSMO-RS solvation models', Wiley Interdisciplinary Reviews: Computational Molecular Science. WIREs Computational Molecular Science, 1(5): 699-709.

Ormsby, B. 2018. 'Dow-Tate Hansen Parameters Fatty acids in modern oil' paper presented at the CMOP Cleaning Modern Oil Paints conference, Amsterdam, 23-25th May 2018. –

Phenix, A. 2013. 'Effects of organic solvents on artists' oil paints.' In proceedings of symposium New Insights into the Cleaning of Paintings (Cleaning 2010), Smithsonian Institution Scholarly Publications/Polytechnic University of Valencia. 69-76.

Zumbühl, S. 2014. 'Parametrization of the solvent action on modern artists' paint systems'. Studies in Conservation, 59(1): 24-37.

Zumbühl, S. 2019. Solvents, Solvation, Solubilization, Solution: The solubility of materials - An introduction for conservators, including solubility data of selected conservation materials. Bern: HDW publications.

A few (mostly) practical notes before starting

- Try to keep swabs and test areas as small and uniform as possible (you can also consider using small commercial swabs for these tests). For even more volume-measurement accuracy a graduated pipette can also be used to deliver solvent to the swab.
- On a varnished paint surface these tests are best compared after surface dirt removal.
- If feasible, carry out preliminary solubility testing of extracted micro-sample material to describe the coating solubility (Zumbühl 2019) then test and plot the most promising solvents in the solvent star.
- If a fast evaporating solvent is being tested it may prove necessary to re-dip the swab for axes 1 and 4 – in this case note on the diagram the total amount of solvent used for the one spot accordingly.
- The Solvent Star is freely available here on SRAL's website. Your completed stars may of course be incorporated into the treatment documentation of the artwork. But it would also **be much appreciated if you could send SRAL a photo/scan of your completed stars** to SRAL to enable future reference, research and developments – please send to g.fife@sral.nl or info@sral.nl
- Lastly, the star is intended for use by professionally trained conservators only. Please be aware that treating art works without formal training can end up like that Bean movie.

What you need

1. 5 solvents
2. swabs, tweezers, used-swab container
3. a small measuring cylinder (or pipette)
4. a timer
5. coloured pens/pencils
6. a ruler
7. a solvent star

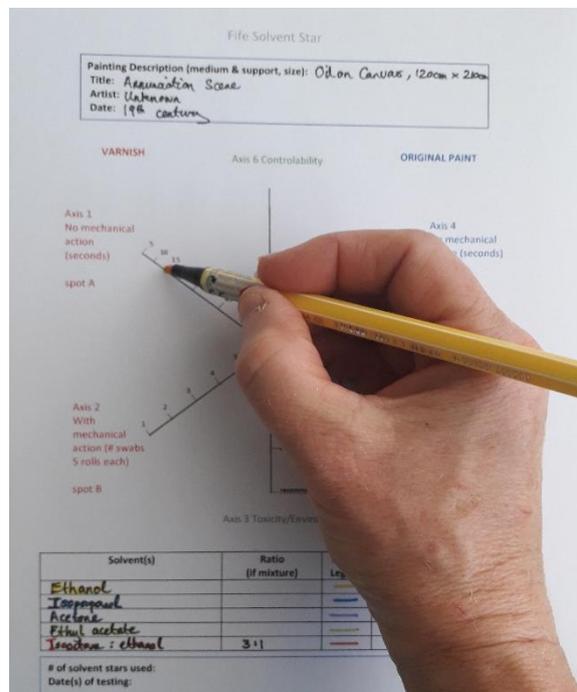
How it works

STEP 1 *fill in the painting details (title/artist/date etc)*

STEP 2 *filling in the first 3 axes*

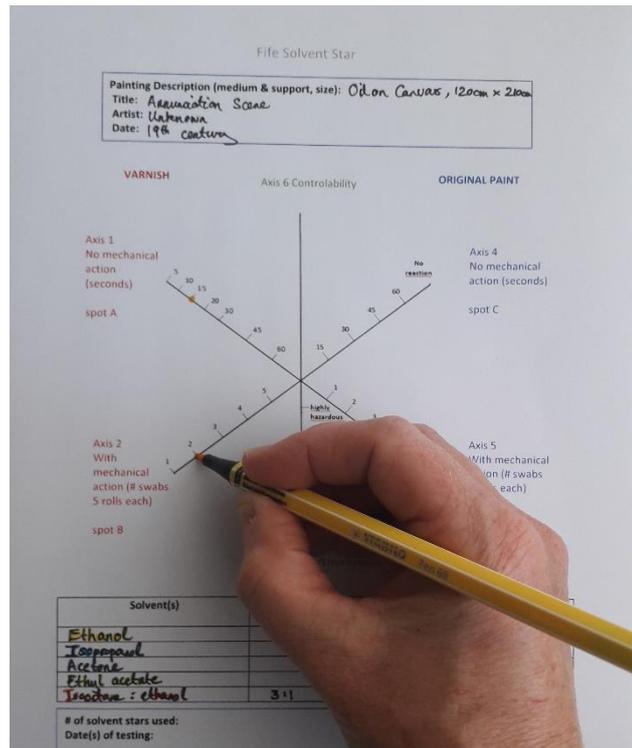
Axis 1. Test spot A - [see also video 1](#)

- Select a spot representative of an area to be cleaned.
- Prepare a small swab
- A small amount of the selected solvent for testing is poured into a small measuring cylinder and the volume noted.
- A small cotton swab is moistened in the cylinder, lifted out (noting volume change in cylinder) and then directly held (without rolling/rubbing) to the surface at this spot A. A timer is started from the moment the cotton swab makes contact.
- Lift the swab to check surface at the noted time intervals, and mark this axis with a small coloured spot **as soon as** any dissolution is noted. (if none occurs after 60 seconds place cross at the origin). See picture 1



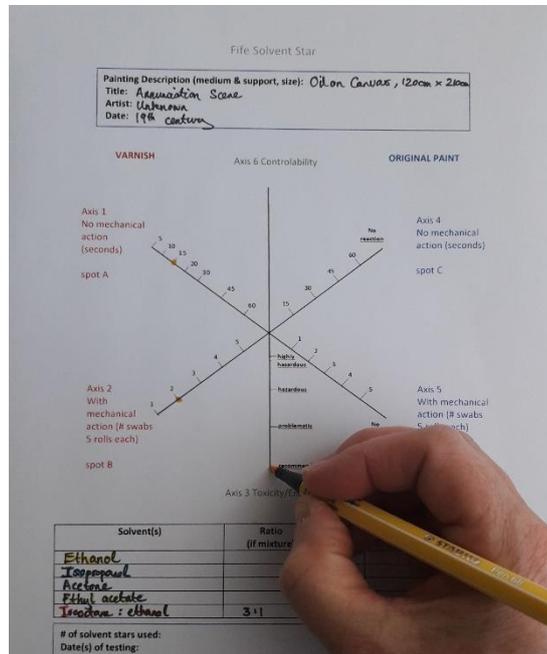
Axis 2. Test spot B – see also video 2

- Select a new spot (but also representative of an area to be cleaned).
- Prepare 5 small swabs
- Repeat the above process for axis one but instead of just holding the swab on the surface, introduce a gentle mechanical action with five very small rolls. If dissolution has not occurred change swab and repeat this (up to five swabs), stopping as soon as any dissolution is noted. Mark a similar spot on this axis referring to the number of the swab at which dissolution occurs. (If none occurs after five swabs place cross at the origin).



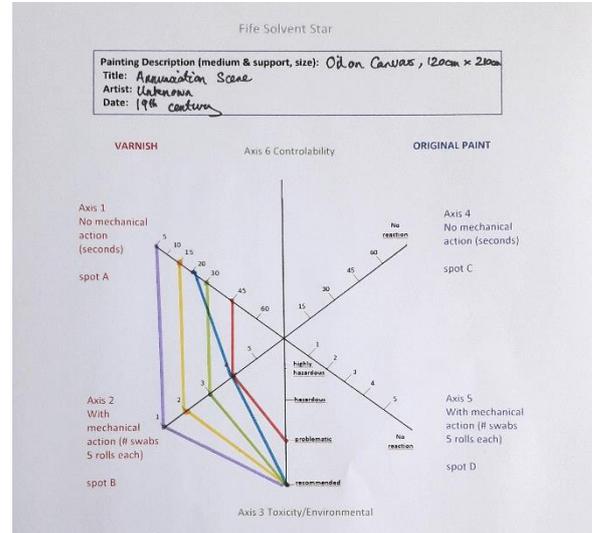
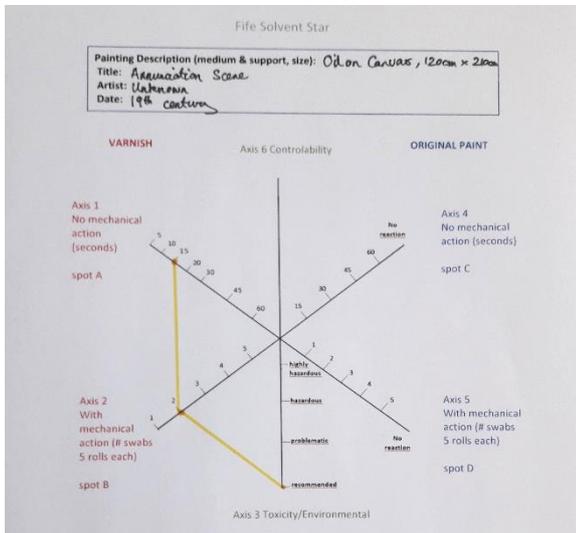
Axis 3. Mark solvent safety/health/environmental considerations

- See accompanying SRAL solvent list – or
<http://learning.chem21.eu/media/pdf/24/tools-and-guides-a4.pdf>,
https://ec.europa.eu/environment/chemicals/reach/reach_en.htm
<https://echa.europa.eu/support/registration/>



Join the first 3 spots you have generated for this first solvent.

Repeat and similarly document these tests in step 2 for the five solvents you have selected. After doing so you will have a partially completed diagram like this.



STEP 3 assessing the first 3 axes

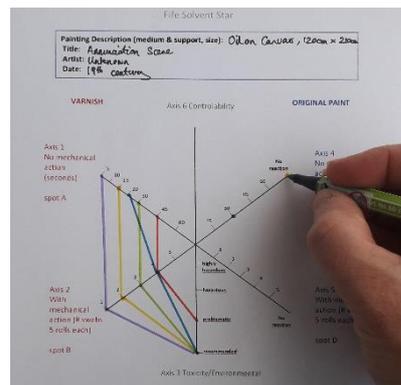
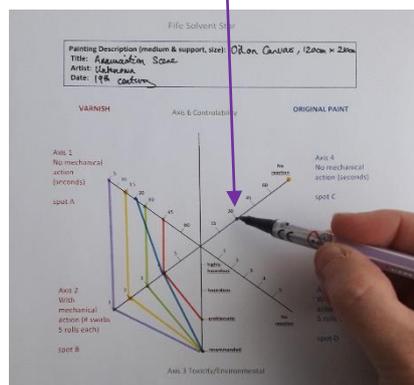
If any of the five show sufficient promise (i.e. fast action) make some slightly larger cleaning windows with your leading solvent(s). Then move on to STEP 4

If none have proven satisfactory consider new solvent types and repeat Step 2.

STEP 4 filling in the last 3 axes

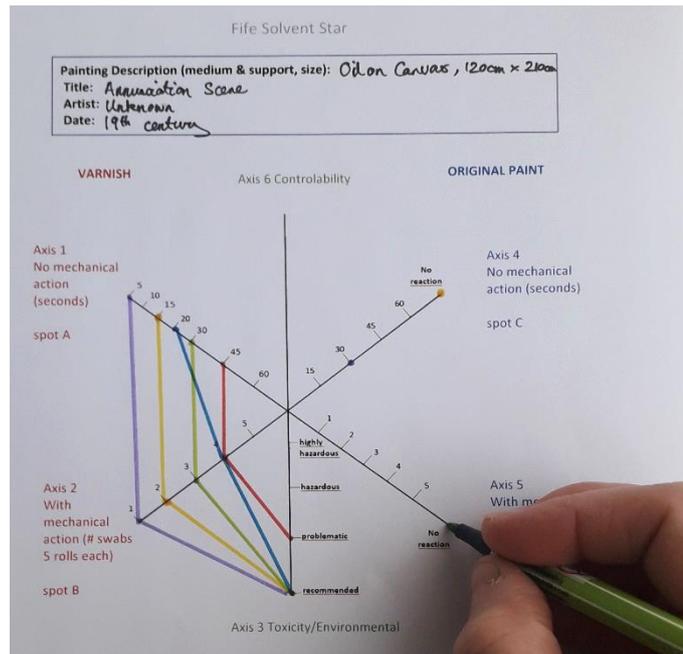
Axis 4. Testing spot(s) C

- Selecting **your most promising solvent** carry out similar steps as for axis one but on a spot representative of the original paint surface. ***If using a small cleaning window from previous testing, allow sufficient evaporation time (atleast 30 mins) beforehand.*** Repeat in as various and many spots as felt required to account for different paint types/colour. Check the swab at the noted time intervals. If at any moment during the 60 seconds there is any indication of swelling/solubility/pigment loss etc. abort testing with this solvent and note time. If only a specific colour/type shows sensitivity this can be noted in the comments section.



Axis 5. Testing spot(s) D

- Similar steps as for axis two are now repeated on a spot representative of the original paint surface. Again, if using a small cleaning window from previous testing, allow sufficient evaporation time (atleast 30 mins) beforehand, and repeat in as various and many spots as felt required to account for different paint types/colour. Check the swab(s) continously. If at any moment there is any indication of swelling/solubility/pigment loss etc. abort test and note swab number. If only a specific colour/type shows sensitivity this can be noted in the comments section (page 2).

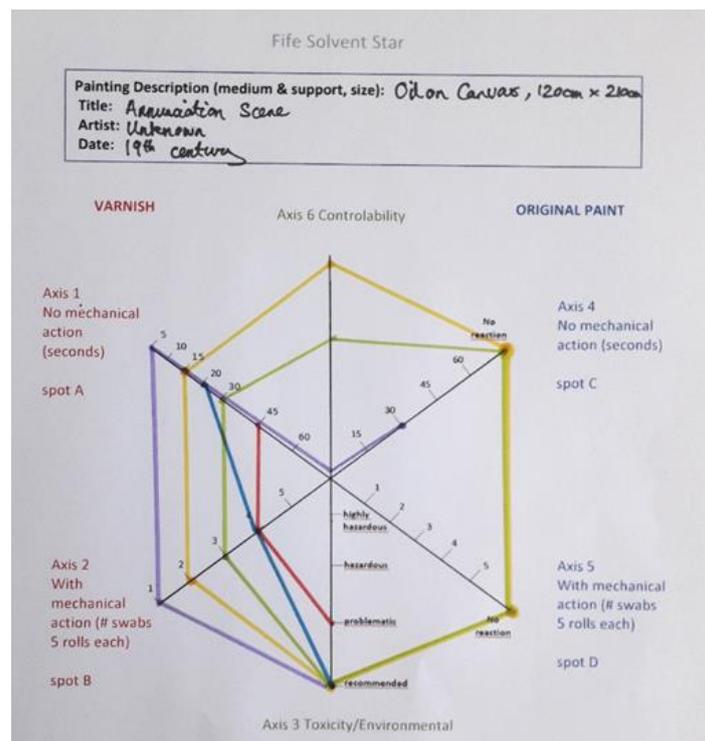


Axis 6. Mark controlability

- On this axis you can express your feeling/comfort with the cleaning action. The better your feeling, the further from the origin you place a small spot. You can also use this axis, for example, to note (dis)satisfaction with the appearance of the revealed surface after testing.

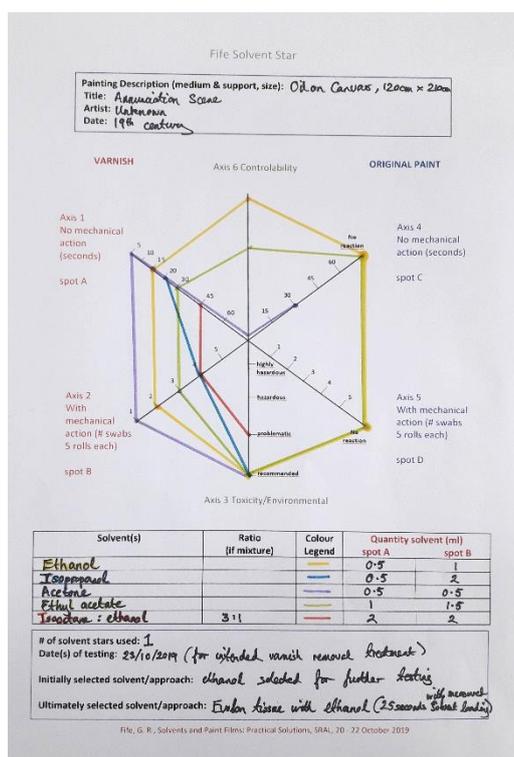
STEP 5 assessing the solvent

Join the 6 spots you have generated for your solvent. Generally the broader the star for an individual solvent, the more successful the result – whilst normally any paint sensitivity noted during testing spots C and D would negate the use of that solvent. If you are completely satisfied with your leading solvent you may proceed with STEP 6. If you are **not** satisfied, or have similarly promising results in step 2 with several of the tested solvents, you can rather repeat step 3 for these also.



STEP 6 further considerations

Once the relative rates of dissolution have been thus illuminated, and potential solvent(s) selected, ways to minimize solvent contact (through adapted applications with thickened solvents/chemical gels/micro-emulsions /tissues/etc.) can be considered and further tested as necessary (i.e. it is advised not to simply extrapolate the behaviour indicated by the free solvent to its adapted form.) The star diagram can then be completed noting the finally selected method for treatment (free solvent and swab/solvent thickened or gelled with../tissue type etc.)



Questions?

See list below - for any further questions please contact g.fife@sral.nl or info@sral.nl

List of questions asked (so far):

1. What if I am needing to remove a transparent coating?

- In step 1, for axis 1, select multiple testing spots close to one another: hold a swab 5 seconds on 1 spot, then 10 seconds on a 2nd different spot, 15 seconds on a 3rd different spot, and so on. After drying you can assess any visual effect on the spots (also with UV light). Similarly you can test the number of swabs (1 spot with 1 swab, 5 rolls, 2nd spot with 2 swabs, 10 rolls, 3rd spot with 3 swabs, 15 rolls, and so on) with visual comparison of spots after drying.

2. What if I'm removing overpaint?

- On star score out VARNISH and write OVERPAINT. Then continue testing as described above but with step 2 focused then on the behaviour of the overpaint.