Visual Acuity
Formal Preverbal Tests

VA Important Part of Preschool Exam
As in adults, VA provides important information on: Integrity of the visual system, and decisions about prescribing
Unlike adults, NEAR VA is not typically done until 4 to 5 years (subject to attending)
Why NOT ?
Often "distance VA is done at a near distance:  TAC, Cardiff card
Time consuming and not much information provided

When to do NEAR VA
When child is in kindergarten ;When parent expresses near concern; When hyperopic or astigmatic correction is on the fence for prescribing; when MEM shows large lag; when on medication that might affect accommodation; when child has condition know to affect accommodation; when your attending asks you

When to Take VA
As in adults, typically done at beginning of exam
Exceptions – Occassionally
If strabismus present & child is under 2.5 yrs
In this case important to get best Rx first, so do informal measure at first visit (F/F or RTO) and then ssess VA at Progress Visit w Rx, using formal measure of VA
If VA not going well consider scope first
Do Monocular VA, NOT binocular

Principles of Preschool VA Tests
Begin the test up close to demonstrate to the child to maximize attention
Select most advanced test that child can do
Children less than 2 do not attend to distance targets well
Record test used, eye tested, test distance, and result

Teller Acuity Cards TAC or ACP
16 cards from 20/30 to 20/3200 from Stereo Optical
Part of Comprehensive Exam CPT code

TAC - Properties
Gratings on one side, nothing on the other side
Constructed so that mean luminance of grating is same as background so when grating is below threshold, not detected
If infant CAN NOT detect grating, tester will be at chance – IF MASKED TO GRATING LOCATION
Cards calibrated for test distances of 38 cm, 55 cm, or 84 cm

TAC - Properties
Card is 55cm long so can use that as a guide to set and maintain test distance
Cards are expensive and fragile so keep hands off front of card
Artifacts on front, can cause preference that invalidates test
TAC - Technique
Based on infants natural preference to look at most interesting object in field
Natural preference is very strong in first 4 to 6 mo making testing easy
As child gets older, more mobile and more interactive with environment have to work
harder to get response

TAC - Technique
TAC is a 2AFC procedure
EXAMINER MASKED TO GRATING LOCATION
Only 2 choices, so need to be sure not at chance 50% chance to be right on each trial
4/4 – 6.25% that could have done that well blindfolded (examiner or baby)
Make sure cards are in order before bringing to examination room
Make sure you have cards and they are in order before you patch the kid
If using TAC or Cardiff Cards need to occlude with opticlede, or other stick on patch
Don’t waste time doing binocular VA before you do monocular VA

Tips for successful occlusion
Use stick on patch and get right size and put in right orientation
May play peak-a-boo first with the patch a few times
Once patch is on, and kid is over 3 months need to keep hands busy or restrained so patch
stays on

TAC- Procedure
Remember the card is 55 cm long so use that as your start test distance
For young kids (generally less than 6 mo) look over the top of the card to observe infant
Older kids may need to hide behind card
View video https://vimeo.com/100417709

TAC - Procedure
Show card with largest gratings (without knowing location of grating)
Make a guess about location based babies behavior and without looking, rotate card, and see if baby follows or looking behavior is consistent first guess.
If behavior is consistent, then look to see if right.
If not, mix up card so stripe location is different and not known, and try again.
Continue presenting smaller size stripes until examiner performance is a chance.

<table>
<thead>
<tr>
<th>TABLE 4. Responses of Subjects at Threshold on First Acuity Test*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responses</strong></td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Raised eyebrows</td>
</tr>
<tr>
<td>Involuntary EM, child rotated</td>
</tr>
<tr>
<td>Reflexive EM, child centered</td>
</tr>
<tr>
<td>Scanning EM</td>
</tr>
<tr>
<td>Pointing, inacc,† used looking</td>
</tr>
<tr>
<td>Pointing to grating position</td>
</tr>
<tr>
<td>Says &quot;stripes/no stripes&quot; with pointing/looking</td>
</tr>
<tr>
<td>Says &quot;right/left&quot;</td>
</tr>
<tr>
<td>Total number of subjects scored</td>
</tr>
</tbody>
</table>

* Percent of subjects scored by age group.
EM = eye movements.
† Inaccurate or unreliable.
TAC - Over 6 months
May be more interested in your face, so may need to hide behind card to get kid to attend to the task
May need sounds, make breeze by fanning the baby, ready, set, go, whatever works for that baby at that age
As child approaches 1 year they will orient to name so use the kids name

To make sure its threshold and not attention or if you feel attention is waning as approach threshold - show large stripe again to regain attention
If does not respond, lost attention and probably not at threshold
Take a very short break from VA to do another monocular test like CF, or EOM
In cases of nystagmus, can present cards vertically

TAC
Record results, Test, Test Distance, Eye, Last card correct, Record c/cm or c/deg, and record the Snellen Equivalent

Monocular TAC Norms

<table>
<thead>
<tr>
<th>Age (Months)</th>
<th># of Children</th>
<th>Mean VA (cyc/deg)</th>
<th>SD (octaves)</th>
<th>VA in Snellen Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32</td>
<td>0.94</td>
<td>0.44</td>
<td>20/638</td>
</tr>
<tr>
<td>1.5</td>
<td>40</td>
<td>1.11</td>
<td>0.42</td>
<td>20/540</td>
</tr>
<tr>
<td>2.5</td>
<td>38</td>
<td>2.16</td>
<td>0.43</td>
<td>20/278</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>2.68</td>
<td>0.47</td>
<td>20/224</td>
</tr>
<tr>
<td>6</td>
<td>40</td>
<td>5.65</td>
<td>0.47</td>
<td>20/106</td>
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<tr>
<td>9</td>
<td>39</td>
<td>6.79</td>
<td>0.43</td>
<td>20/88</td>
</tr>
<tr>
<td>12</td>
<td>40</td>
<td>6.42</td>
<td>0.29</td>
<td>20/93</td>
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<td>18</td>
<td>40</td>
<td>8.59</td>
<td>0.37</td>
<td>20/70</td>
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<td>24</td>
<td>40</td>
<td>9.57</td>
<td>0.27</td>
<td>20/63</td>
</tr>
<tr>
<td>30</td>
<td>40</td>
<td>11.52</td>
<td>0.48</td>
<td>20/52</td>
</tr>
<tr>
<td>36</td>
<td>39</td>
<td>21.81</td>
<td>0.36</td>
<td>20/28</td>
</tr>
</tbody>
</table>
Adjusting the Norms
Children born more than 1 month early need to have expected VA adjusted by amount of prematurity until 8 months of age
If 6 month old and 2 months early, expected VA would be that of a 4 month old
No adjustment needed after the 8 months of age

Rules of Thumb
To convert cy/deg to Snellen fraction divide cpd into 600 for denominator of Snellen fraction
Over first 6 months, VA in cpd is age in months
2 months old =2cpd = 20/300

TABLE 3. Interocular Acuity Difference
Norms for the Acuity Card Procedure

<table>
<thead>
<tr>
<th>Age Group (months)</th>
<th>N</th>
<th>0 (exact)</th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>32</td>
<td>69</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>40</td>
<td>75</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
<td>2.5</td>
<td>38</td>
<td>76</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>63</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>40</td>
<td>80</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>39</td>
<td>77</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>12</td>
<td>40</td>
<td>80</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>40</td>
<td>73</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>40</td>
<td>75</td>
<td>98</td>
<td>100</td>
</tr>
<tr>
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<td>100</td>
</tr>
<tr>
<td>36</td>
<td>39</td>
<td>69</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>48</td>
<td>32</td>
<td>56</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>460</td>
<td>72</td>
<td>99</td>
<td>100</td>
</tr>
</tbody>
</table>

Availability of TAC
Bernell
Full Set is $4,050.00
Half Set is $2,199.95
Stereo optical was past supplier, but on web says to contact them

TAC Imitators
KAC (Keeler Acuity Cards) Children’s Grating Test
8 Cards, 10.5 x 22.5 inches (57.15 cm)
$1,800.00
LogMAR 0.4 LogMAR 2.2
( Snellen 20/20) to 20/3400)
38 cm test distance
Goodlite/ Richmond Products
City-Cardiff Infant Grating Test
Provides 18 Cards with Acuity Gratings
Covers 20/2000 to 20/17
$1,500.00 Goodlite/Richmond Products

Other FPL Grating Tests
Lea Grating Paddles – Suggested for Birth to 18 months
1 Gray
3 with gratings on each side
0.25 c/cm, 0.5 c/cm; 1 cy/cm; 2/cy/cm; 4 cy/cm; 8 cy/cm
Less Expensive
$250.00
Concerns
Not validated; a more difficult time to keep attention;
Examples available from:
Good lite/Richmond Products
Patti Stipe
4 paddles - significantly less expensive than TAC TAC and more durable than TAC
7in x 12.5 inches
6 gratings at 0.3, 0.6, 1.2, 2.4, 4.8 and 9.6 cy/cm

Precision Vision

Cardiff Cards
Based on vanishing optotypes
Figure is constructed of 3 lines - Center WHITE line flanked by 2 BLACK lines
Each black line is half width of the center line
Width of center white line and viewing distance determine VA, NOT overall size of picture
When not detected – card looks blank

Cardiff Cards are best for 1 year until kid can do Lea 2AFC (2 to 2.5yrs) or Lea naming (2 to 2.5 years), or HOTV matching about 3 years
Figures more interesting for older kids but closer separation of pictures so may be harder to tell location
Cardiff Cards
3 cards at each level with picture is at the top or bottom
Some levels of VA have 2 at top and 1 at bottom, other levels have 2 at bottom and 1 at top
Can be done at any distance but no calculation required of done at 50cm or 1m
If child points or touches picture may need to be closer and calculate

Cardiff Cards are typically a detection task but can be used as a recognition task
PL like TAC

Detection task - 12 months to 2 or 2.5 years
Name or sign the picture
Recognition task – 2 to 2.5 years and up
But if can to HOTV matching or Lea 2AFC these are preferred
Cardiff Cards
DETECTION METHOD
You are MASKED to location & rely on kids looking behavior as with TAC
Set UP
ARRANGE in ORDER before beginning test
Select 2 cards (one up and one Down) for each level
Occlude the child with stick on occluder
Start with poorest VA to get feel of looking behavior
Without knowing location of picture
Show one card of set and decide location based on kids looking or pointing behavior but DON”T LOOK
Show second card to see if location is opposite first card
Will need to attract child’s attention to card
If so look to see if correct
If not, mix up cards and try again

Don’t need to show every set of cards
After showing largest set
Estimate expected VA based on child’s age
Start about 3 to 4 levels above (easier) the expected and test until at chance
As get close to threshold need to do more than the 2 trials per level as 2 trials on 2AFC can happen 25% of the time when kid really can’t see it

Cardiff Cards
Observe for other cues as approach threshold
Moves closer to the card
Scans the card up and down but no preference
As with TAC, if losing attention, go back to poorer VA level to get attention back or take a break and do another monocular test

Cardiff Cards - Recording
Must Record the name of the test, the eye tested, the test distance, the Test Card (Card A-I); If at 50 cm or 1 meter, Snellen equivalent on back of card but be sure you look in the right place
If not at 50 cm or 1 m will need to calculate VA

Cardiff - Norms
Not well established or at least not published
N=21 deaf/blind kids
VA similar with TAC and Cardiff
N 90 kids similar VA but greater variability with Cardiff

Set of 36 cards if both test distances (50 cm and 1 m) considered VA range from 20/320 to 20/12.5
2 year old should get at least 20/40
With TAC and Cardiff the interpretation is
Kid can see at least that level maybe even better IF you were MASKED and did the test correctly
Cardiff Cards –
Bernell
12 cards 20/320 to 20/12.5 (if consider testing at 1 m and 50 cm)
1,799.95
Goodlite/Richmond
1,800.00